Aquatic Invertebrates of South African Rivers

Field Guide

A Gerber & MJM Gabriel

First edition
February 2002

Institute for Water Quality Studies
Department of Water Affairs and Forestry

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Director : Institute for Water Quality Studies
Department of Water Affairs and Forestry

Private Bag X313
Pretoria
0001

Tel 012 808 0374
Fax 012 808 2702
or
Annelise Gerber
Cell 082 808 9844
GerberA@dwaf.gov.za

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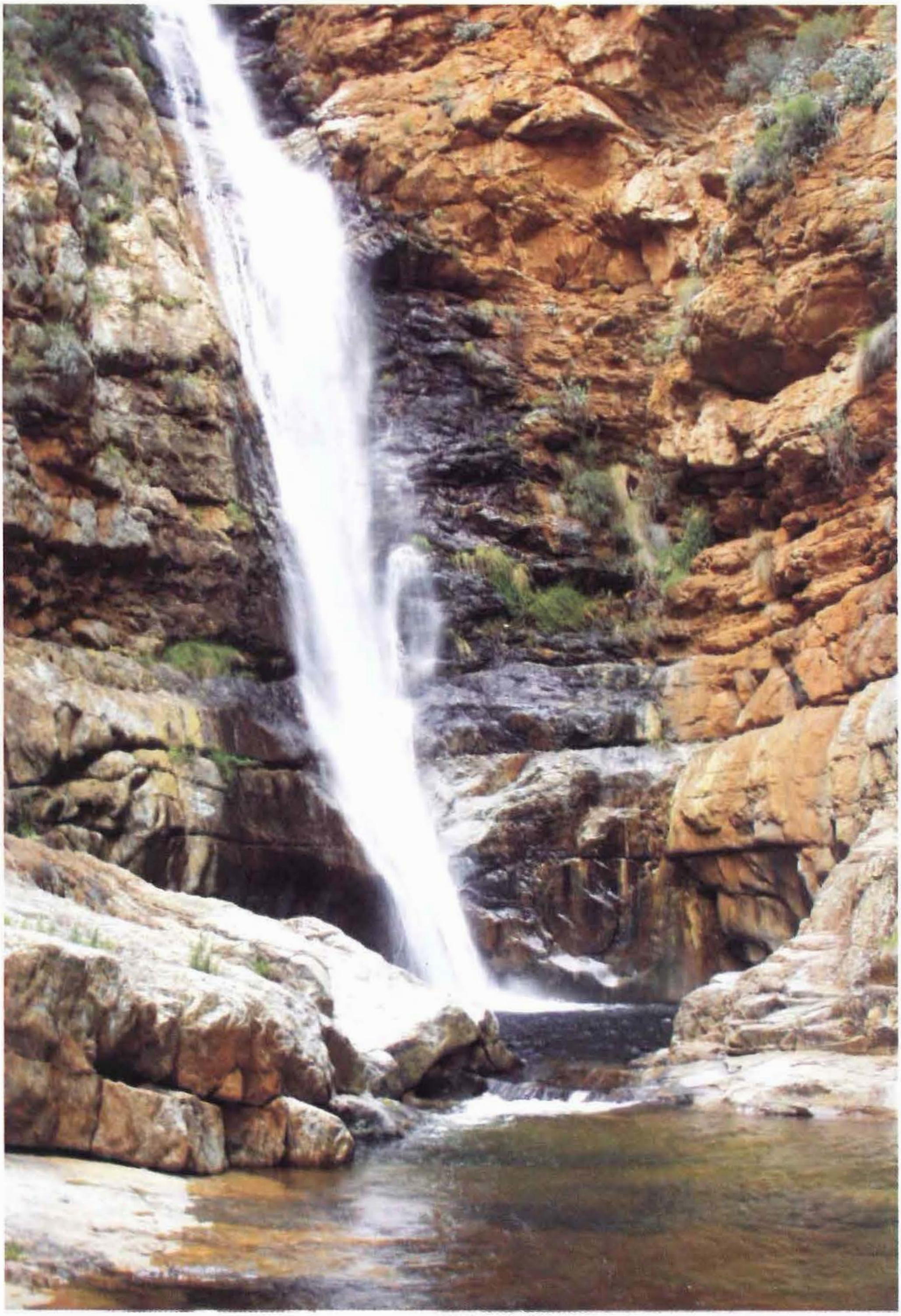

Waterfall in the Swartberg mountains, Meiringspoort

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Acknowledgements

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Prof. Jenny Day
Dr Ferdy de Moor
Mrs Irene de Moor
Dr Chris Dickens
Mr Mark Graham
Ms Mary Anne Groepe
Mrs Helen James
Dr Nikite Muller
Dr Martin Villet

Editing:

Mr Brendan Hohls
Mr Mike Silberbauer

Collectors:

Christa Thirion
Petro Vos
DWAF regional offices personnel
DEAT provincial and local personnel

General:

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Lastly, special thanks to our families for their patience, understanding and the part they played in the realisation of this book.

Introduction

In field surveys, it has often been observed that non-biologists encounter problems when identifying aquatic invertebrates. The common problems include:

- Taxonomic keys are difficult to decipher and comprehend

- Certain anatomical features are described in specialised taxonomic terms that are unfamiliar to the lay person

- Line drawings accompanying these keys often only vaguely resemble the organism

Purpose of this field guide

It was felt that there was a need to develop a more user-friendly guide. One that would:

- Use photographs of live organisms

- Describe them in layman's terms

Who should use this field guide ?

- People who are interested in aquatic invertebrates and would like to know more about them.
- People with little or no taxonomic background.
- Water Resource managers.
- Officers or personnel who assess water resources, especially river ecosystems, using standard biomonitoring techniques to assess instream aquatic invertebrates.
- Children who, in turn, will follow in the footsteps of those we ourselves follow.

Structure of this field guide

The authors would like to acquaint the reader firstly with the characteristics of the aquatic ecosystems (water resources) where these organisms can be found and then with the invertebrates themselves. The structure of this document is as follows:

Part 1 - Water Resources

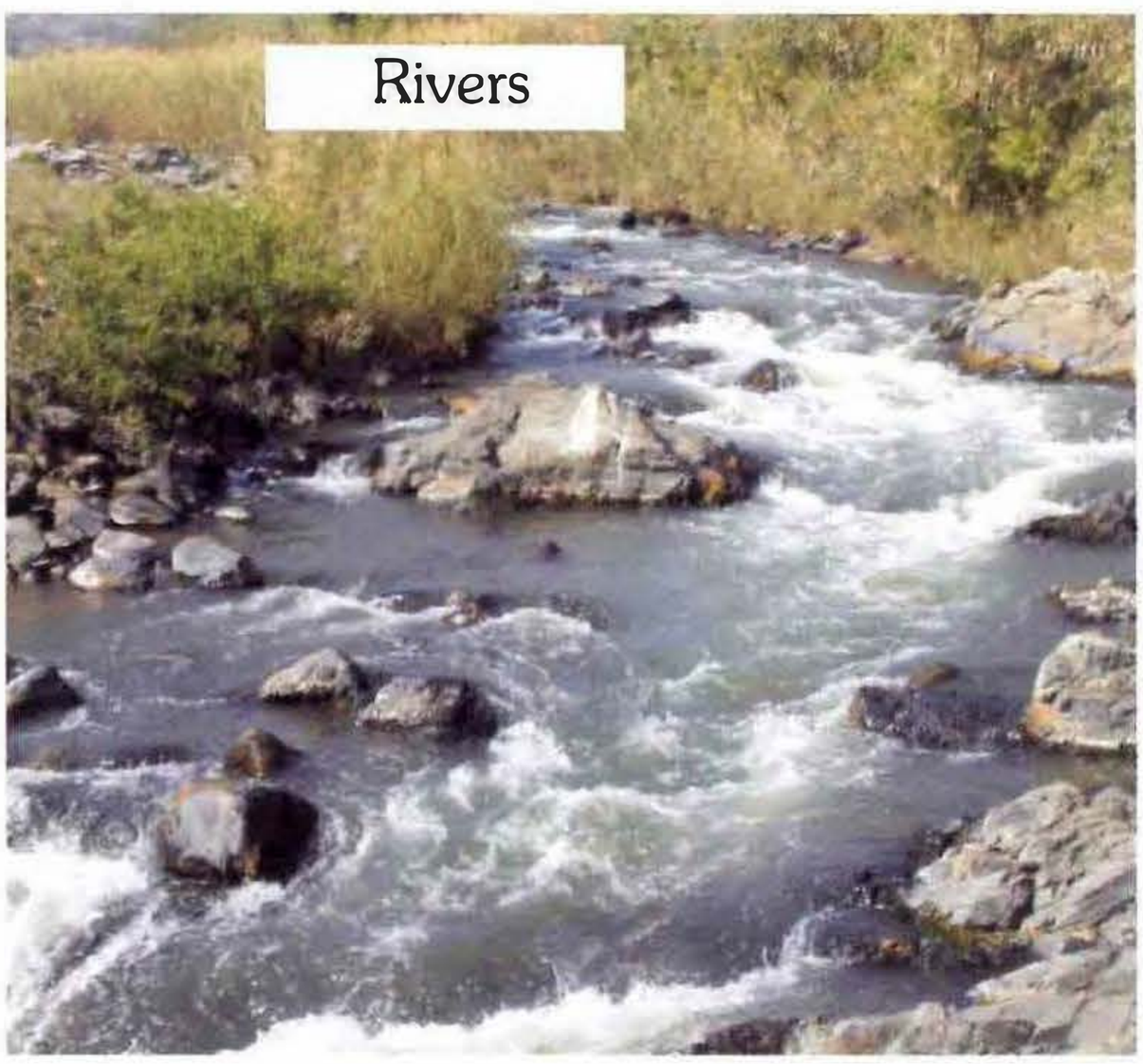
General Classification of water systems

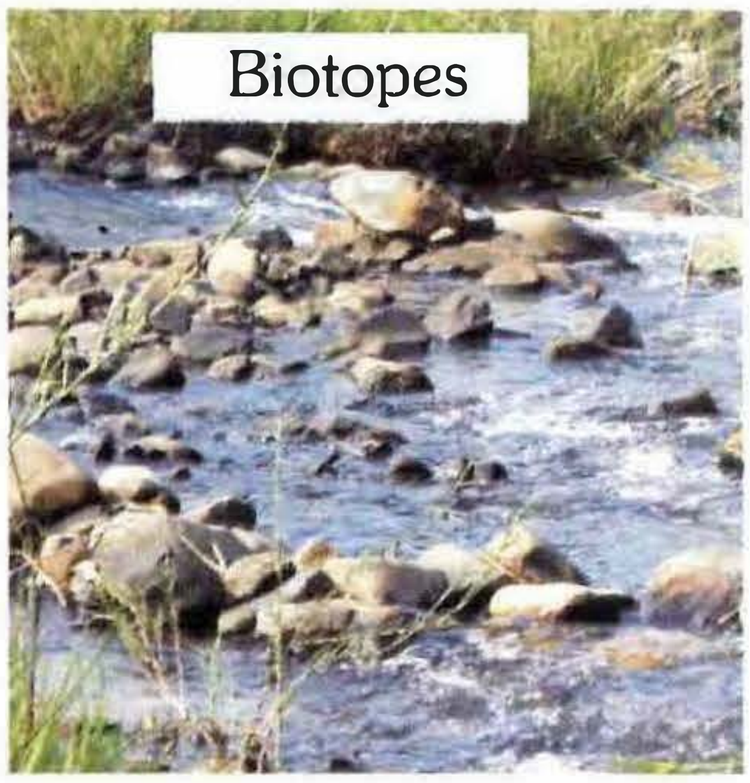
A general river ecosystem

Biotopes in rivers

Guide to river substrate particle sizes

Part 2 - Fresh water invertebrates





Invertebrates

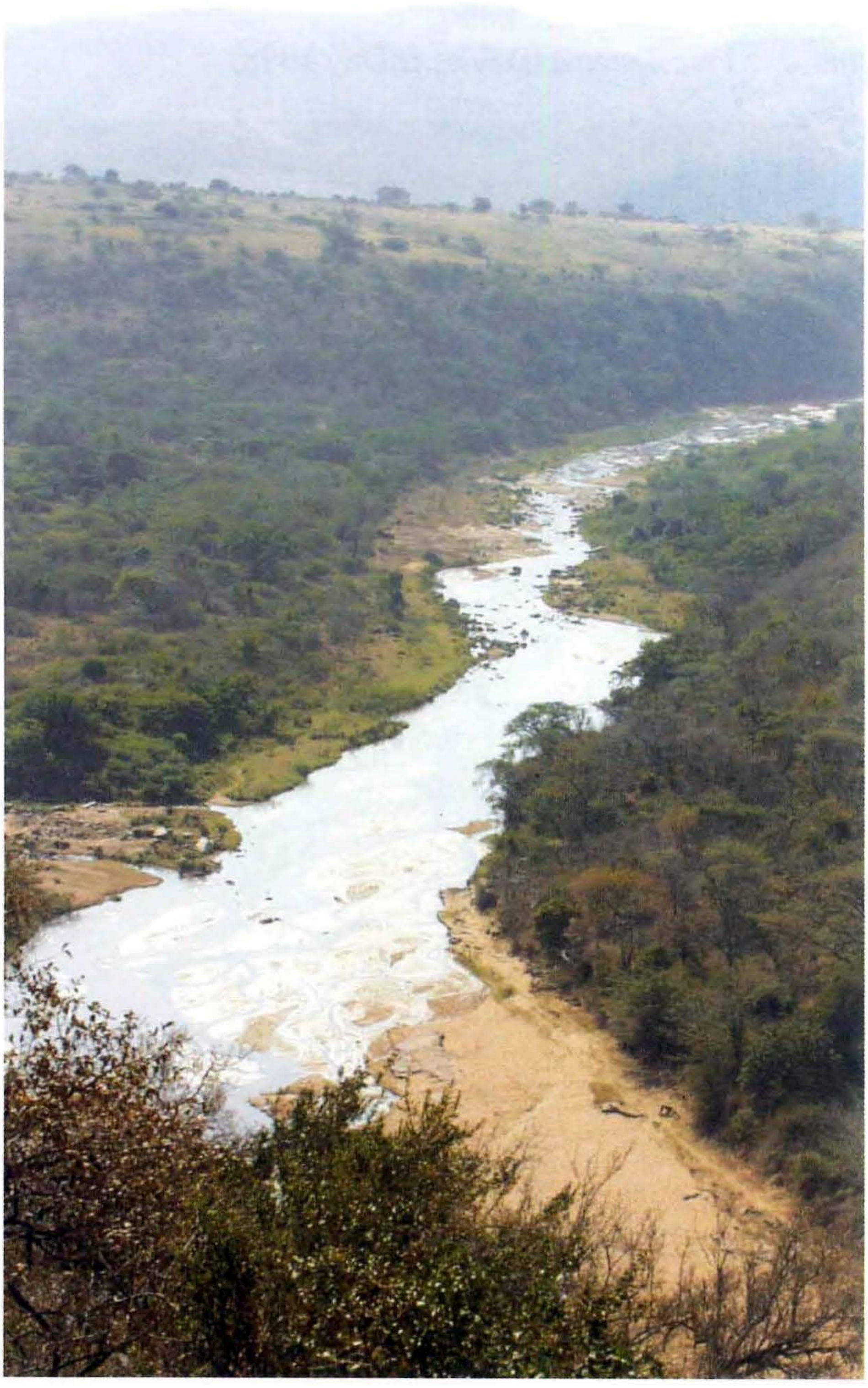
Part 1: Water Resources

A typical river, free from interference of man, would run its course from its source to the sea. Starting either as a spring or as seepage, it moves slowly as it joins up with other tributaries through the foothills to become wider and deeper as it reaches its estuary.
In South Africa, few rivers can be found in this state because water is a limited resource and is often utilised by a growing population for activities such as agriculture, industry, domestic use and other purposes.

Reservoirs , on the other hand, come into being through natural causes (such as a landslide e.g. Lake Fundudzi) or are man-made (e.g. Hartbeespoort Dam). Over time, a lake would naturally change into a wetland and eventually disappear as it fills up with silt and becomes dominated by emergent and terrestrial plant species.
Currently, the dams, which are constructed in our river systems, are undergoing these changes at a much faster rate due to the effects of the human activities mentioned above.

Water resources, specifically rivers, can have different characteristics in different geographical regions. This may be due to the:

- geology
- geomorphology
- climate
- soils, and
- human activities in the catchment.



Mfule River, Kwazulu Natal

Classification of water systems

Water resources can be classified into two general groups :

- lentic systems, and
- lotic systems (Davies & Day 1998)

Lentic systems

Lentic systems are defined as standing waterbodies and include:

- lakes
- ponds
- farm dams
- coastal lakes
- estuaries, and
- some wetlands

Buffeljachts Dam, Swellendam

Lotic systems

Lotic systems are waterbodies where water flows such as:

- rivers
- streams, and
- floodplains

Palmiet River, Western Cape

In South Africa rainfall is largely erratic and thus floodplains and other wetlands can change from lentic to lotic and vice versa or, in some instances, can dry up until the next good rains arrive.

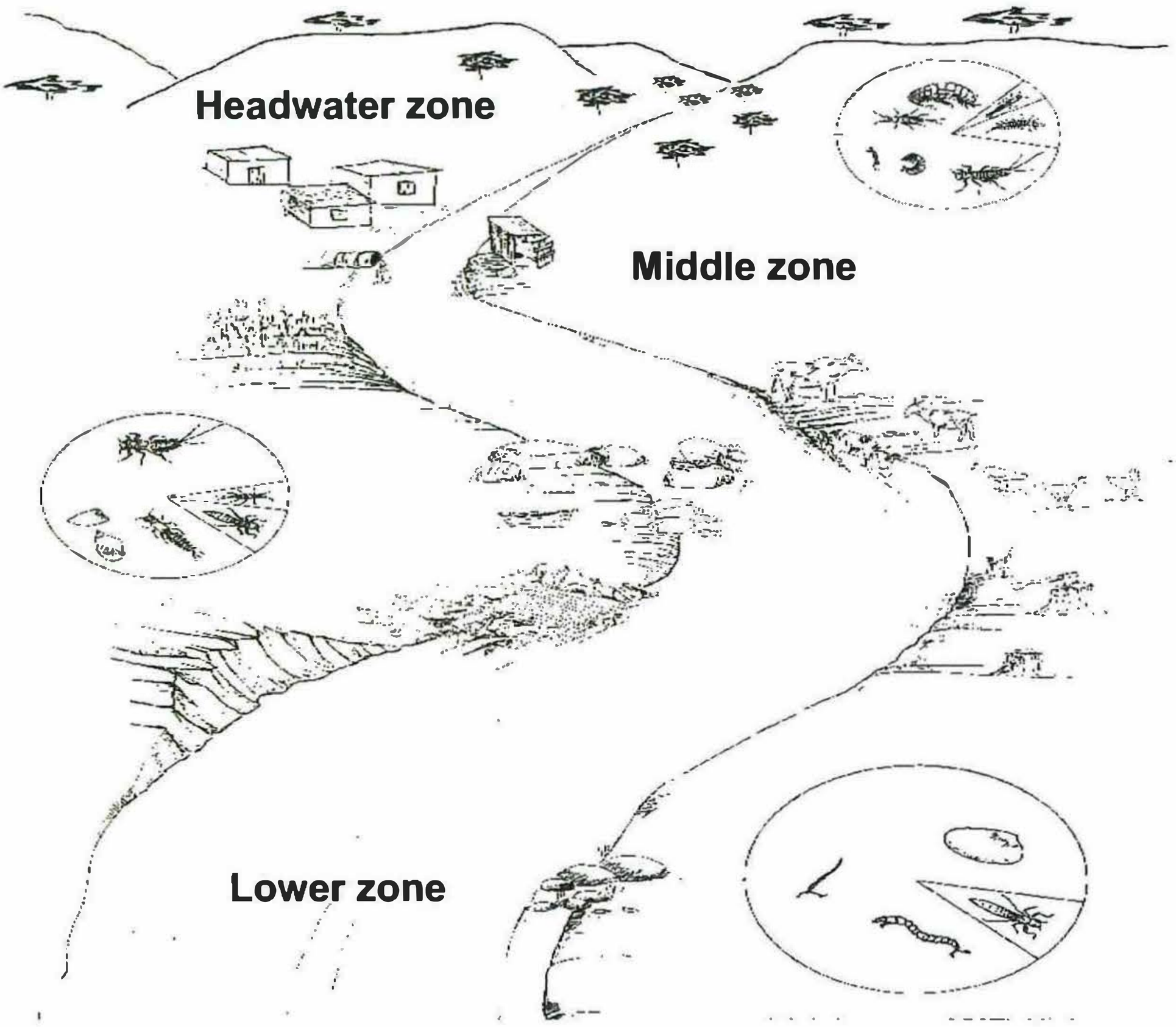
Different species of organisms inhabit these different systems. In this book we focus mainly on rivers and on invertebrates found in these lotic systems.

A general river ecosystem

To simplify matters, a general river ecosystem will be broken up further into different zones as described by Dallas & Day (1993):

- The headwater zones - mountain stream
- The middle zone, and
- The lower zone

However, there are many exceptions to this e.g. some of the rivers of the southern Cape or where a rejuvenation zone occurs. A rejuvenation zone is one where the river characteristics change once again to resemble a head water zone or middle zone.

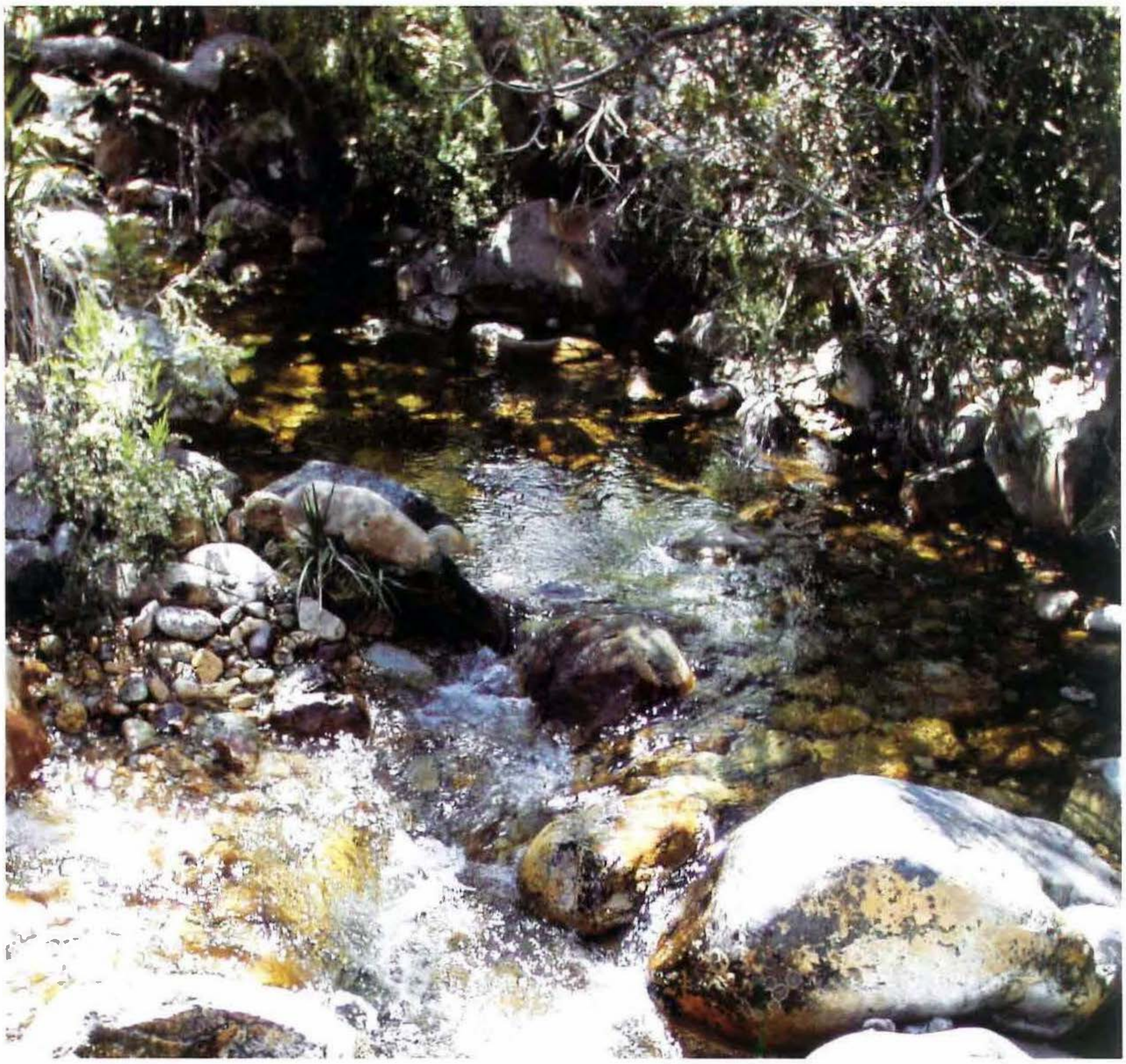


Diagrammatic representation of a general river ecosystem (based on the River Continuum Concept of Vannote, Minshall, Cummins, Sedell &Cushing 1980)

The Headwater zone

A typical mountain stream is characterised by:

- Clear, fast flowing water - well oxygenated
- Gradients often steep, causing swift currents
- Stream bed usually composed of stones and boulders with very little loose soil.
- River banks are often lined by large trees with branches shading the streams for a large part of the day.
- Plants growing on and near the river bank form the riparian vegetation.



Headwater zone of the Eerste River, Western Cape

Some rivers arise in high altitude wetlands, called sponges. (Wetlands are areas with water logged or saturated soils dominated by emergent vegetation i.e. plants with roots in water but the rest of the plant is aerial, such as grasses and reeds). These rivers have different characteristics including:

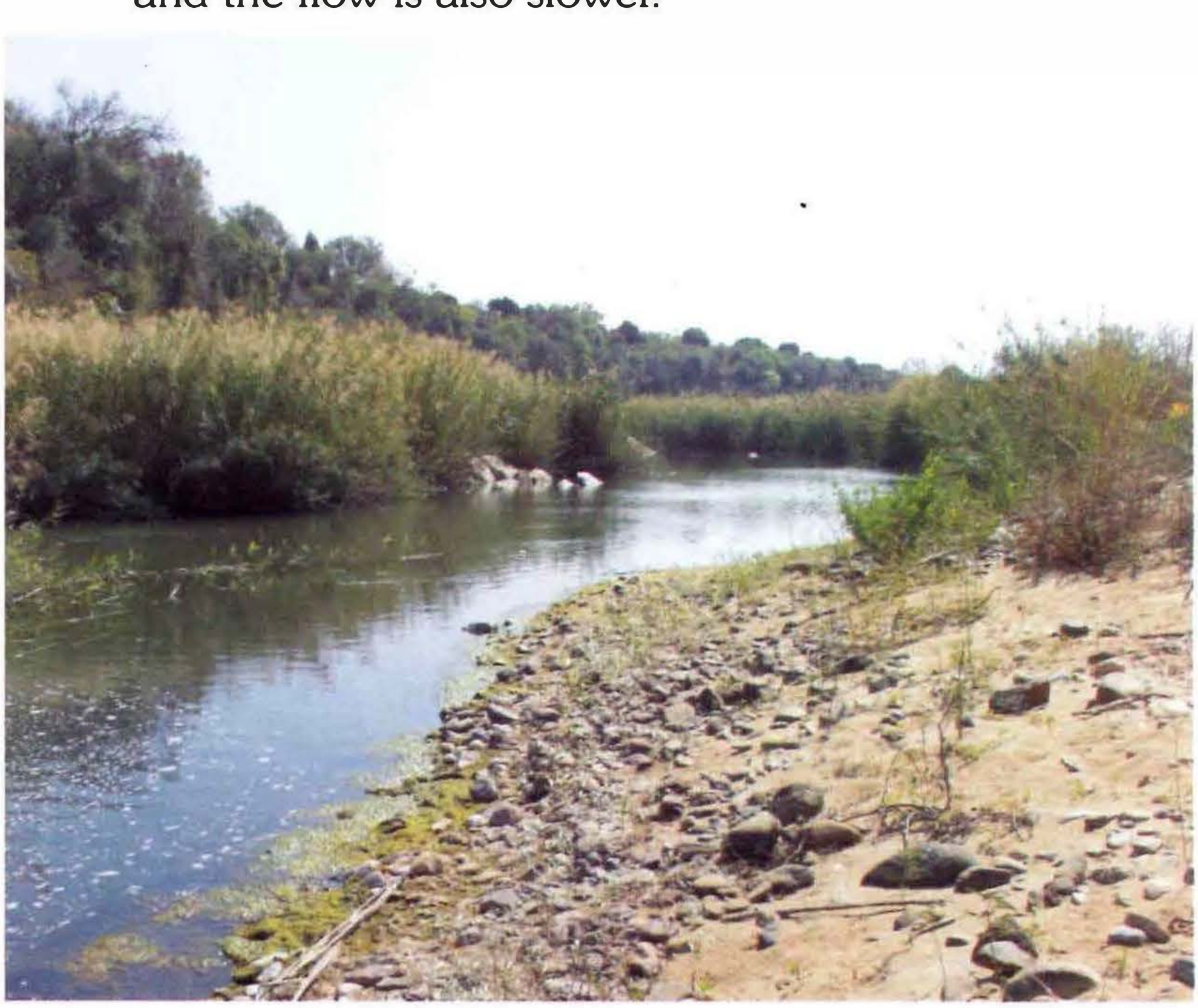
- Stream bed composed of sand, mud or clay or a mixture of these.
- Riparian vegetation dominated by reeds and grasses.
- No overhanging tree canopy.

Headwater zone of the Crocodile River, Dullstroom

The middle zone

This section of the river lies in the lower altitudes of mountains (foothills). This zone is characterised by:

- Stream is wider due to contributions of tributaries (other streams).
- Current speed slower due to the gentler slope.
- Flow of water less turbulent - stream bed smoother
- Water quality is often less pure than that of the mountain stream due to abiotic processes e.g. leaching and biotic activities of organisms living upstream.
- Water is usually more turbid - depending on the geology and the contribution of the tributaries
- Higher water temperatures than head waters - because there is no closed canopy, altitude is lower and the flow is also slower.

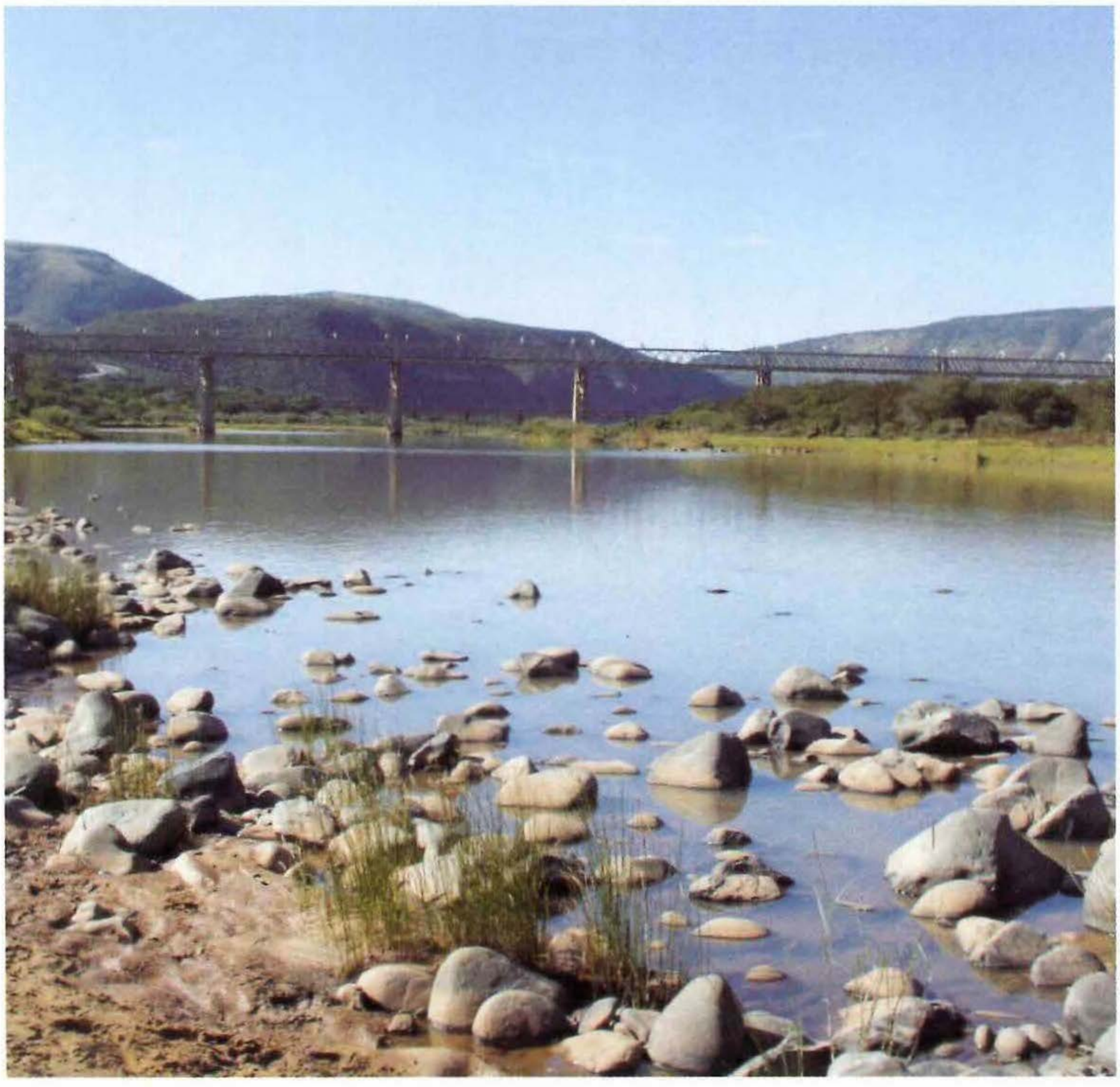


Middle zone of the Crocodile River, Mpumalanga

The lower zone

As the river flows towards the coastal plain, in the lower reaches above the estuary, it's:

- Channel continues to widen.
- Current speed decreases further.
- Stream bed is composed mainly of sand or silt.
- Oxygen concentration is often considerably less than those of upper zones due to higher temperatures and more biologically active material in the water.
- Water quality is poorer due to leaching & weathering of rocks
- Rich in nutrients due to contributions of its tributaries.
- Increased sunlight penetration - algae may be observed.



Lower zone of the Kei River, East London

Lower zone of the Orange River, loaded with sediments and nutrients

Lower zone of the Crocodile River at Nongoma,
Kruger National Park

Biotopes in a river ecosystem

The stream bed composition is one of the most important physical factors controlling the structure of a freshwater invertebrate community (Mackay & Eastburn 1990). The stream bed can be further described by biotopes.

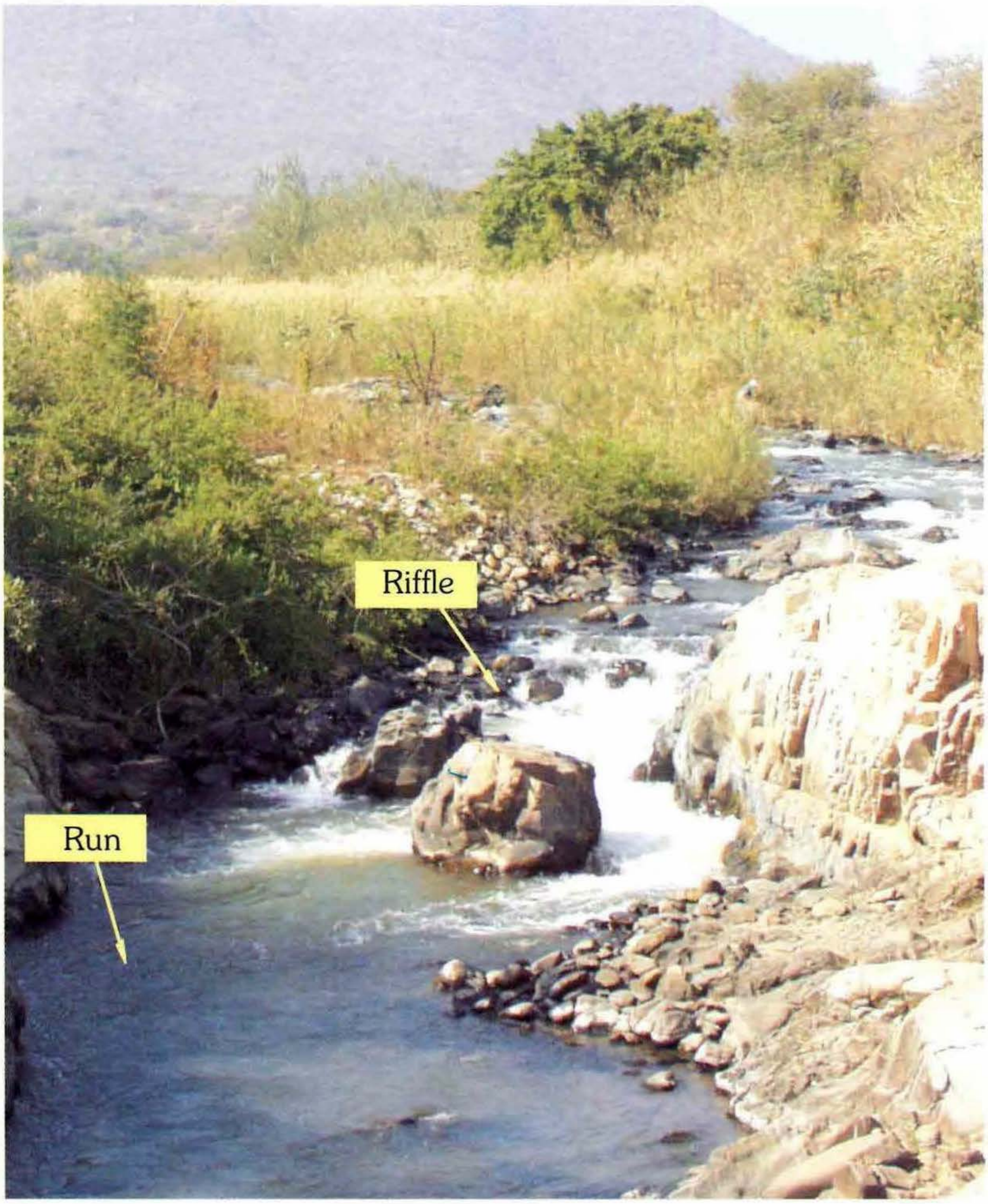
A biotope in a river ecosystem refers to the environment of a community of closely associated organisms (F. de Moor, I.J. de Moor & H. James pers comm). A brief description of different types of biotopes found in river systems is also included. These are:

- Riffles and runs
- Pools
- Aquatic vegetation
- Marginal vegetation
- Algae

Riffles and Runs

Riffles are defined as shallow, fast-flowing reaches of a river where the water flows over cobbles and gravel, causing turbulent flow, and broken water is observed on the surface.

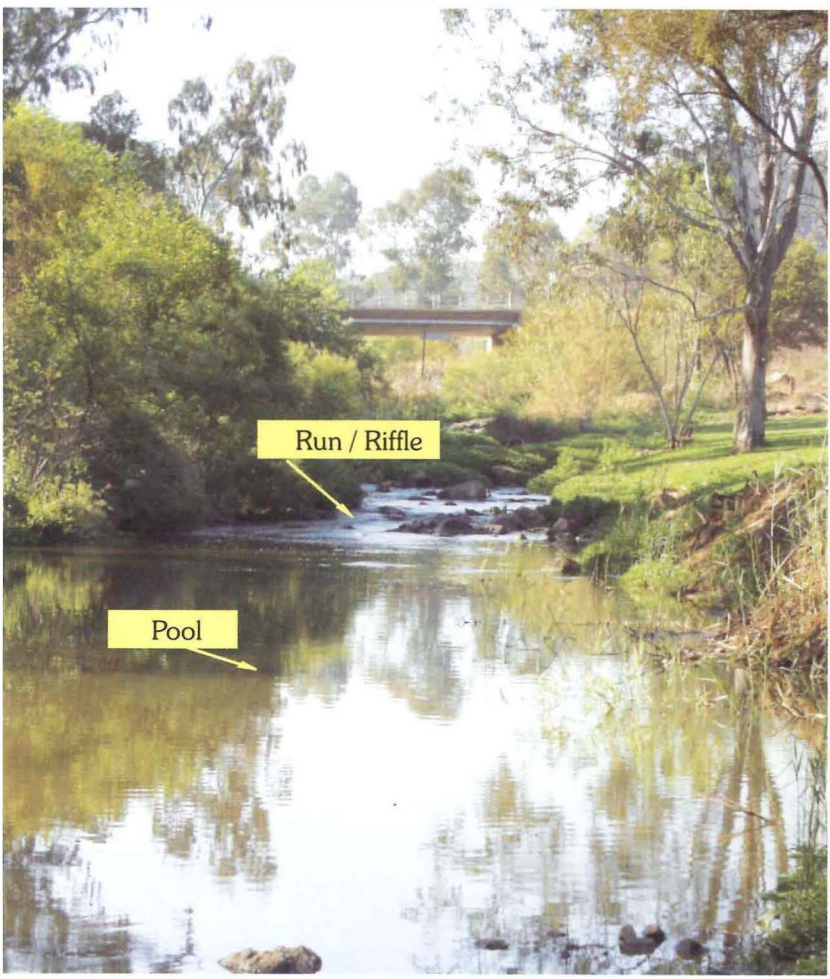
A run has tranquil flow, no broken water on the surface and has a greater depth than riffles (Wadeson 1994, Rowntree & Wadeson 1999).



Crocodile River, Mpumalanga

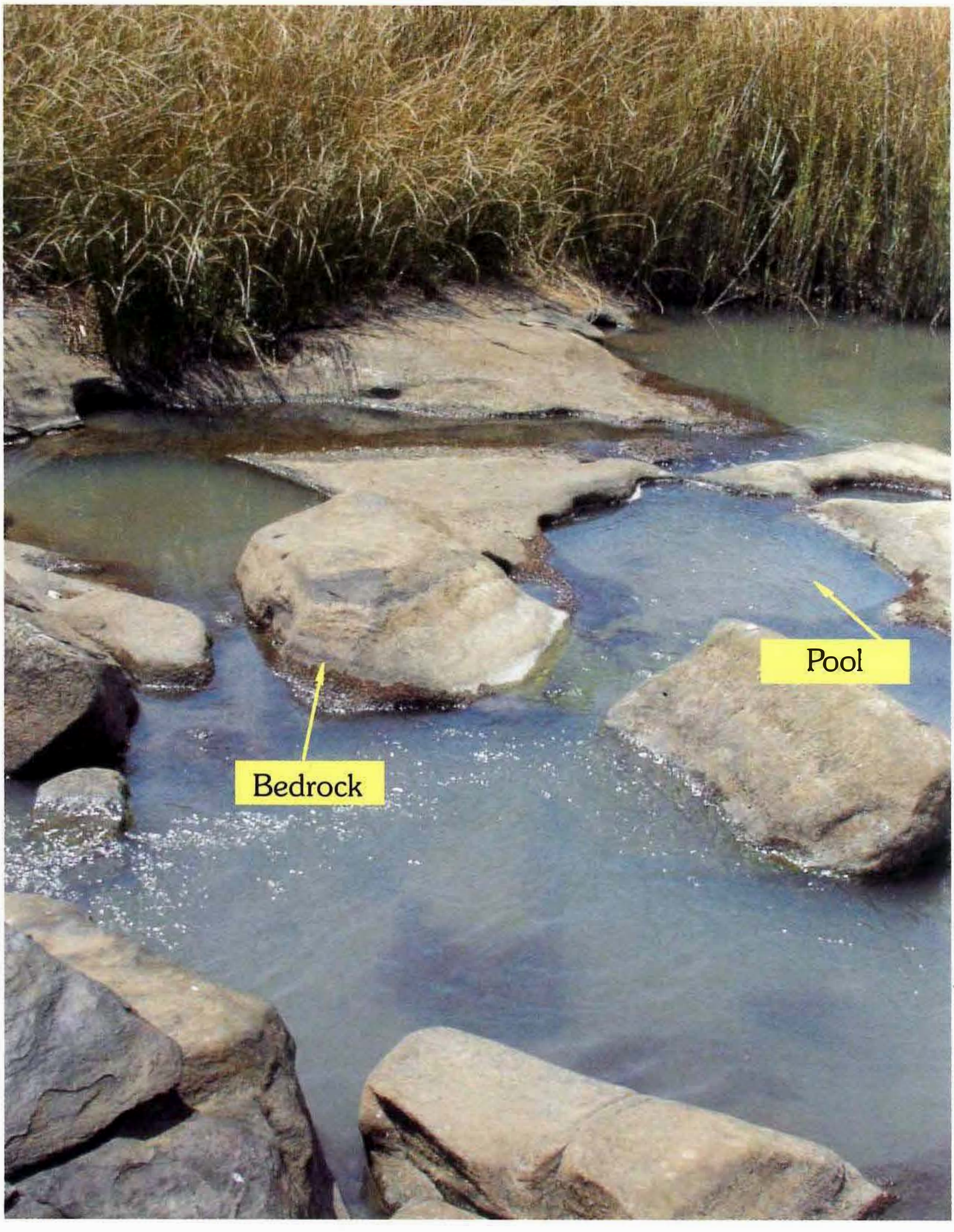
Pools

A pool is an area of a stream that is deep and where the water flows more slowly than in other parts of the river.



Pienaars River, Gauteng

It can also be a collection of water that is not in the main stream of the water flow e.g. in hollows formed in the bedrock.



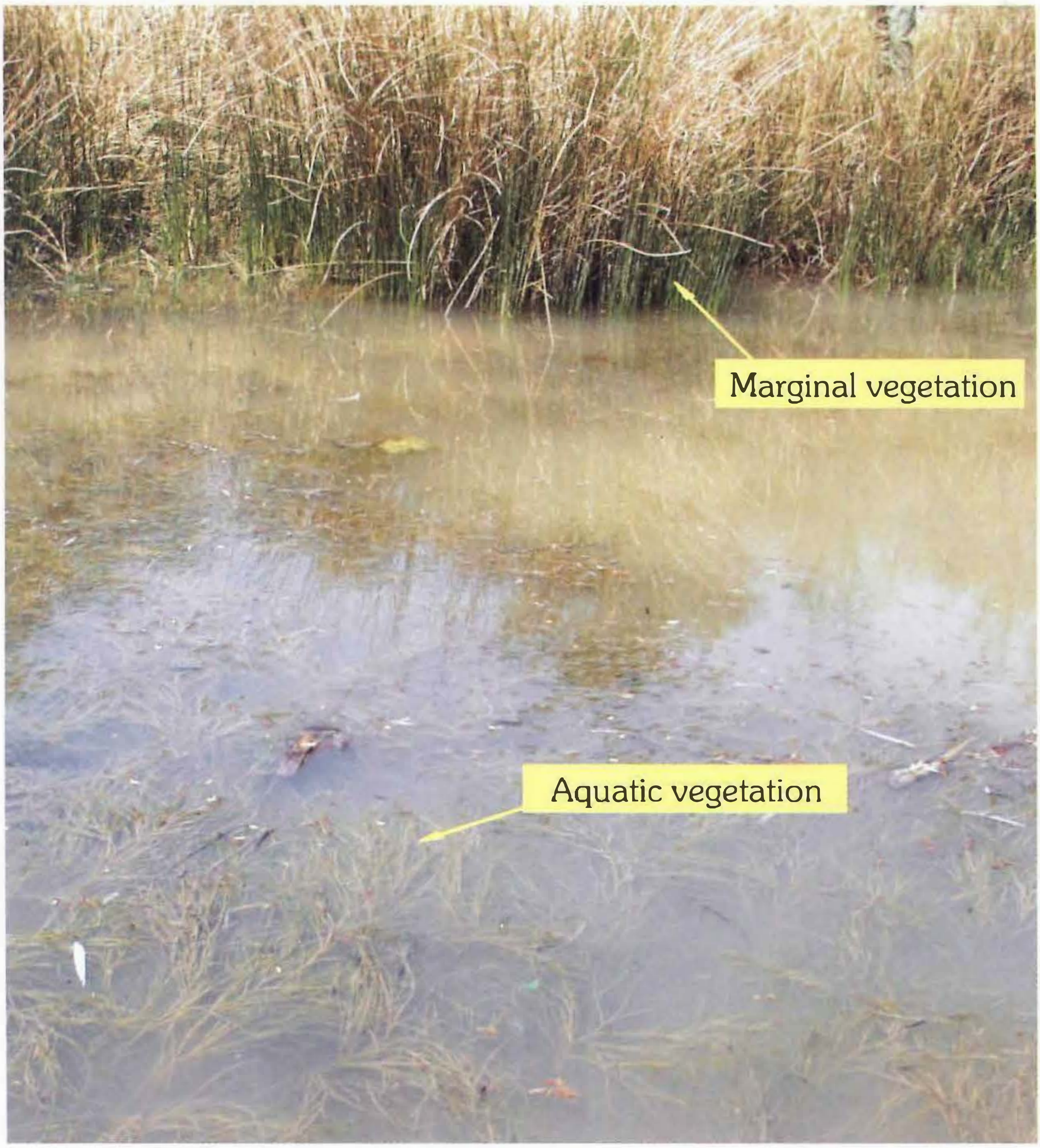
Wilge River, Mpumalanga

Aquatic vegetation

Aquatic vegetaion consists of plants that live in the stream channel and that may be partly or fully submerged.

Marginal vegetation

Marginal vegetation is that vegetation, for example grasses, reeds and sedges, on the water's edge.



Sand River, Orange Free State

Algae

Freshwater algae are simple plants which can occur in unicellular, filamentous or colonial forms . A primary characteristic of algae is that photosynthesis is the primary mode of nutrition (Wentzel 1983).
Algae is often observed during the warmer times of the year floating as clumps or anchored to rocks and stones. Nutrient enrichment is a result of nutrient rich agricultural runoff, industrial and domestic effluent entering the river can accelerate algal growth resulting in algal blooms.

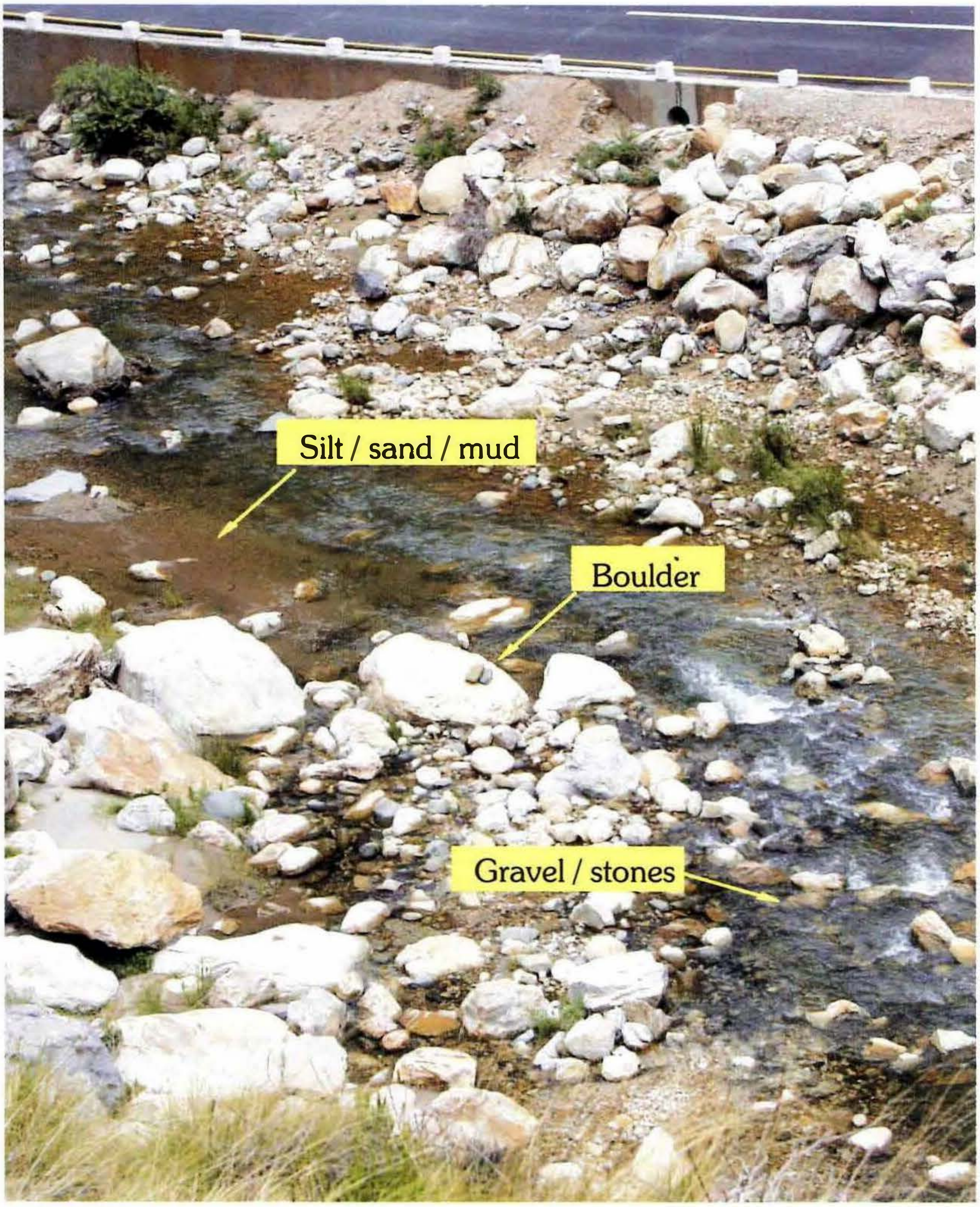
Sand River, Orange Free State

Guide to river substrate particle size

The material that constitutes or composes the bottom of a river is called the substrate. The substrate often characterises the different zones and biotopes found in a river. For example, headwater zones of a typical river would have a substrate composed of boulders and bedrock which will gradually change to cobbles and pebbles (collectively called stones) as it flows in the middle zones and eventually become sandy and silty in the lower zones. There are exceptions where the underlying geology sometimes changes this pattern and where hard geological formations cross rivers in lower regions causing "rejuvenation" leading to waterfalls, rapids etc. Table 1 provides a guideline on the sizes of substrate material found in river beds. Information obtained from Dickens & Graham (2001) & J.M. King (pers comm)

Kaaimans River, Southern Cape

Category	**size range**
Silt	< 0.06 mm
Sand	0.06 - 2 mm
Gravel	2 - 20 mm
Stones	2 - 30 cm
Boulders	> 30 cm
Bedrock	slabs of rock



Stream, Meiringspoort

Part 2: Freshwater Invertebrates

Freshwater invertebrates are animals without backbones, large enough to be seen with the naked eye, which live a part of their lives in freshwater biotopes (Machay & Eastburn 1990). Each animal will be confined to that part of the river where chemical and physical conditions are suitable for it (Davies & Day 1998).

Thus as the river flows from its source to the sea, the different freshwater invertebrates would be found in different parts of the river. Some will be adapted to the fast flowing waters of the mountains, others to the slower current of the lower part of the river while yet others may be adaptable and can be found all along the length of the river. Just as rivers can be different so it can be expected that there will also be differences in the invertebrate communities in the respective rivers.

This part of the book describes freshwater invertebrates found in South African rivers. Because many of the invertebrates collected are in the larval and nymphal stages, most of the descriptions are based on those stages.

Explanatory notes

SWC

Distribution restricted to rivers of the Southern and Western Cape

Approximate Size

The grey inserts shows the most likely size of an animal that anyone can expect to find in the field.

Sensitivity

The sensitivity scales were derived from the tolerances to pollution as used in the SASS5 scoring system.(Dickens and Graham, 2001)

A broad explanation would be as follows :

1-5 Highly tolerant to pollution

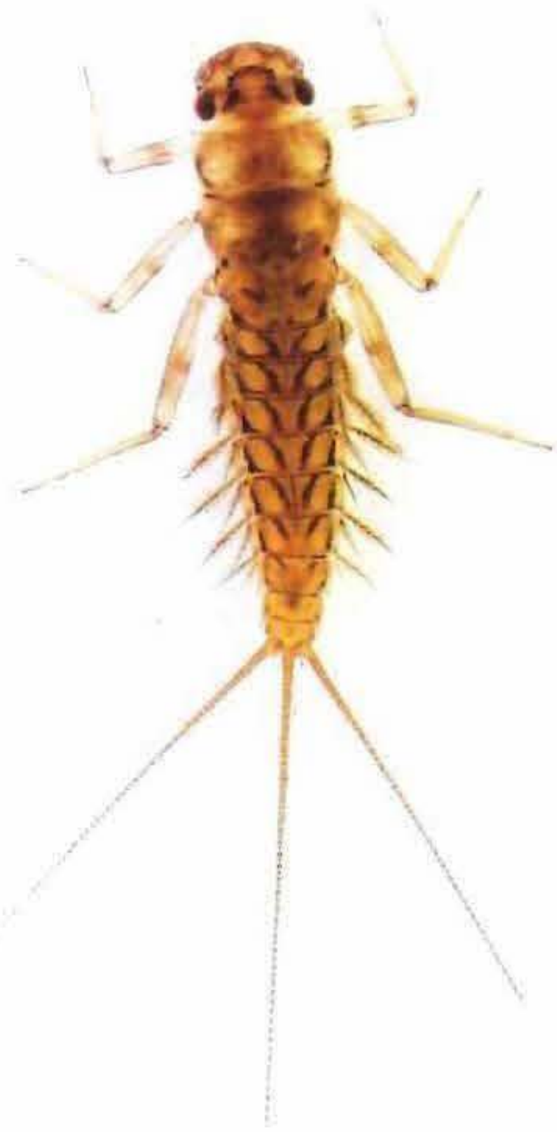
6-10 Moderately tolerant to pollution

11-15 Very low tolerance to pollution

ORDER : EPHEMEROPTERA
Mayflies

Mayfly nymphs vary greatly in shape and size, all are very well adapted to suit the variety of habitats that they occur in. The climbers, bottom sprawlers and burrowers prefer quiet waters of ponds or backwaters of streams while the clingers are to be found in fast riffles where they cling to rocks or any other submerged substrate.

All mayfly nymphs are characterised by an elongated body, large head, well- developed mouthparts and stout legs.
Paired gills on the abdomen are the most characteristic feature to distinguish mayfly nymphs from other insects.
These gills vary greatly, they can be typically leaf-like, oval or even fringed. Three tails are always present, except in the family Baetidae where some species only have two tails.



Mayfly nymph

The family Prosopistomatidae does not match the characteristics as described above. Prosopistomatidae nymphs has flat, oval bodies with no visible gills and a short stubby tail.

Fully developed nymphs will only come to the surface when they are ready to transform in which case the outer skin is shed and the first adult stage emerges.
This adult (subimago) will sit undisturbed on vegetation for anything from a few minutes to 24 hours until another layer is shed and the final adult (imago) emerges.

Adult mayfly

Adult mayflies are dainty insects with transparent wings and long tails. They can be spotted in the vicinity of fresh water on calm sunny days or in the evenings when they are attracted to lights.

Adult mayflies only live for a few hours in which time the female will mate and lay eggs.

Family name : Baetidae

Common name : *Small minnow flies*

Structure

- Small spindle-shaped bodies
- Leaf-shaped gills on both sides of the abdomen
- Two or three tails, depending on species

Behaviour

- Dart actively from stone to stone or cling onto various substrates

Habitat

- Rocks, plants or coarse sand
- Moderately fast streams

Colour

- Light sand to dark brown

Sensitivity

Young and mature stages of *Baetis harrisonii*

Approximate
Size

Approximate
Size

Approximate
Size

Approximate
Size

Different Baetidae nymphs

Family name : Caenidae

Common name : *Cainflies*

Structure

- Nymphs relatively small
- Humped backs
- Two prominent square gills

Behaviour

- Swim in short bursts, dolphin-style, or crawl slowly over the substrate

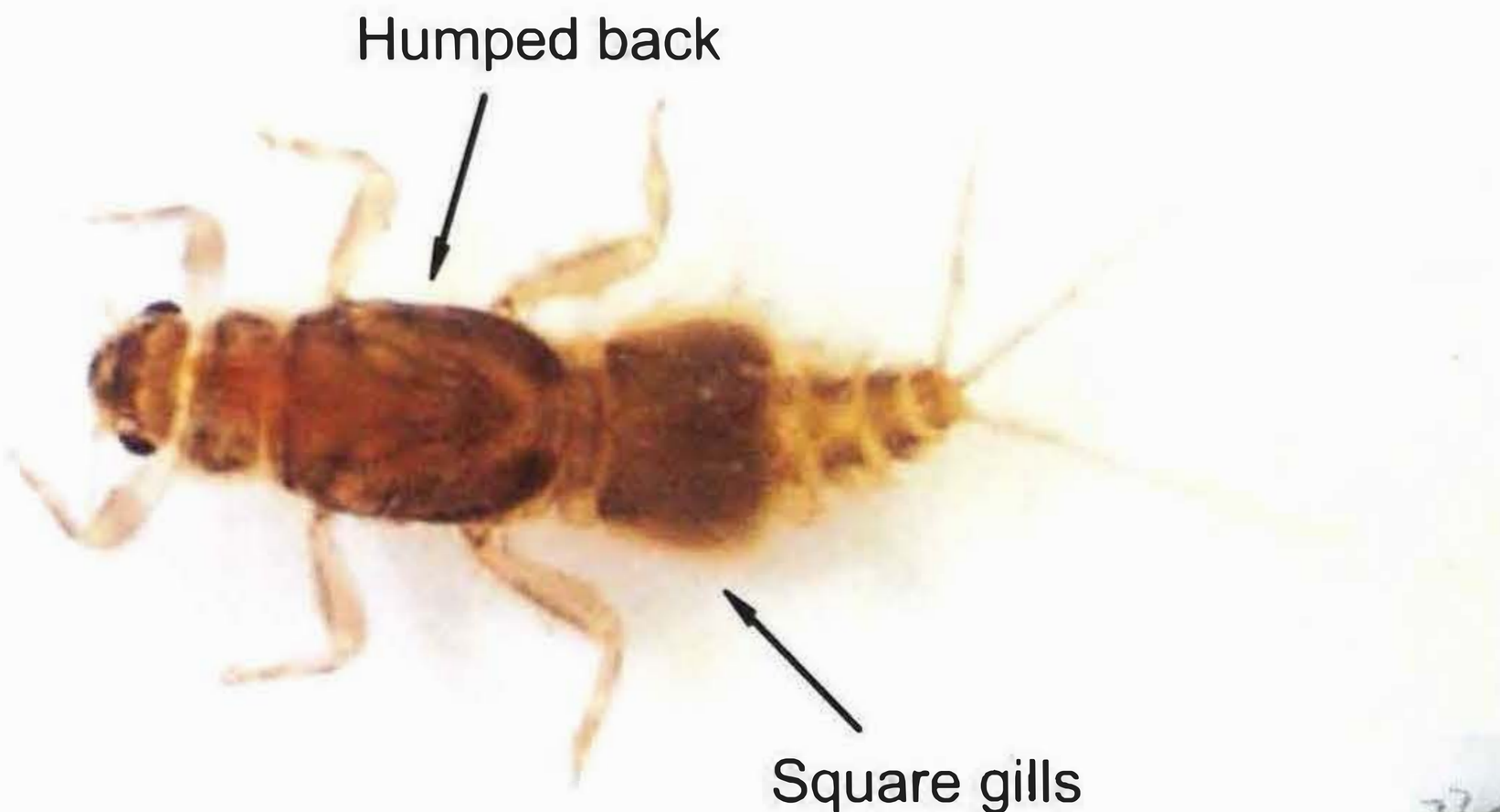
Habitat

- Stones or muddy areas
- Slow or very slow streams

Colour

- Brown

Sensitivity



Approximate Size

Caenidae nymph

Family name : Heptageniidae

Common name : *Flat-headed mayflies*

Structure

- Unusually broad head
- Long spread-out tails
- Large black eyes
- Flat body

Behaviour

- Runs swiftly over short distances
- Legs are held close to the body when at rest

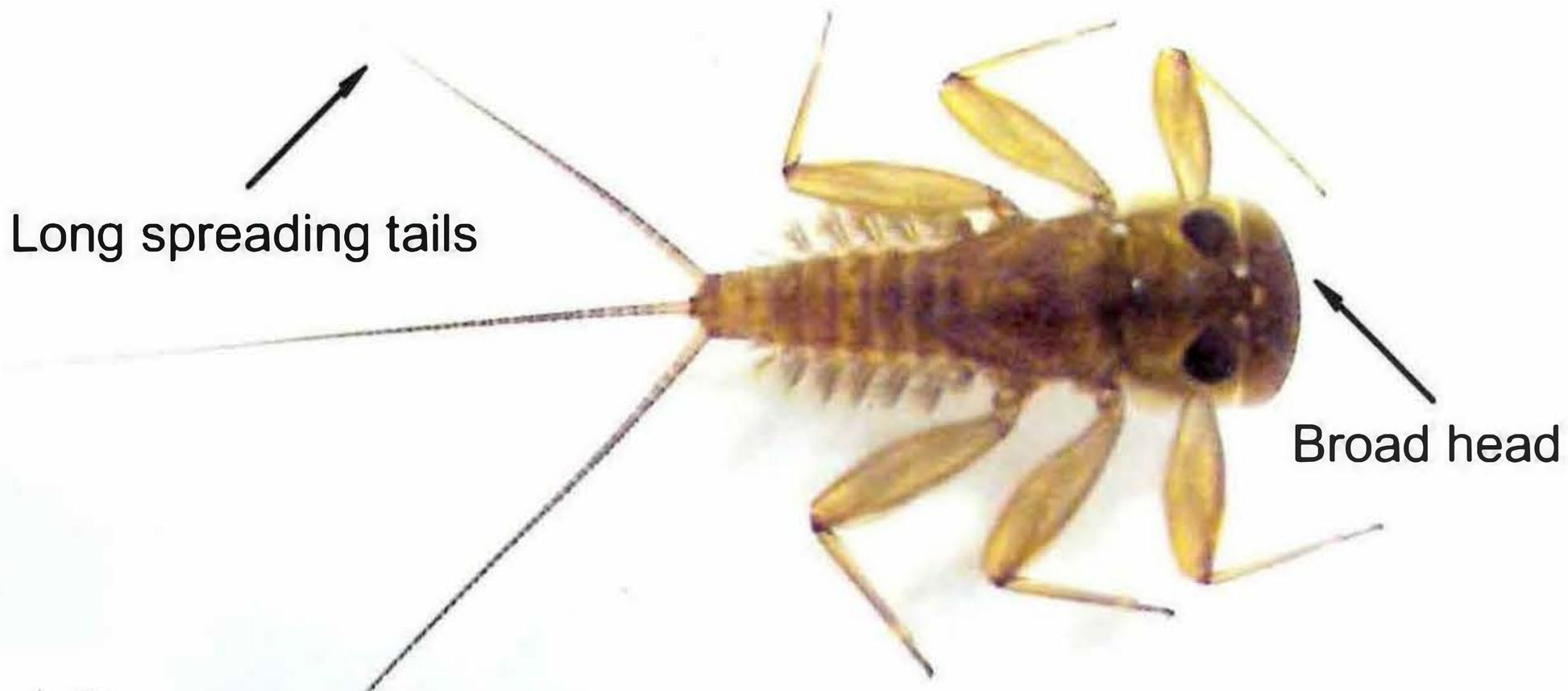
Habitat

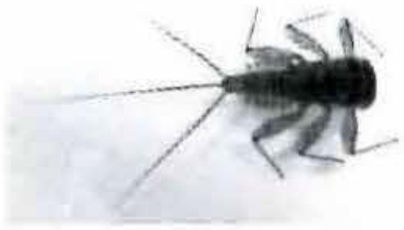
- Stones or submerged pieces of wood
- Moderate to fast flowing streams

Colour

- Grey, yellow, dark brown or black with speckles

Sensitivity





Approximate Size

Heptageniidae nymph

Family name : Leptophlebiidae

Common name : *Prongills*

Structure

- Square heads
- Very long, spreading tails
- Feathery, leaf-like gills on both sides of abdomen

Behaviour

- Running over the substrate
- Swimming dolphin-style for short distances

Habitat

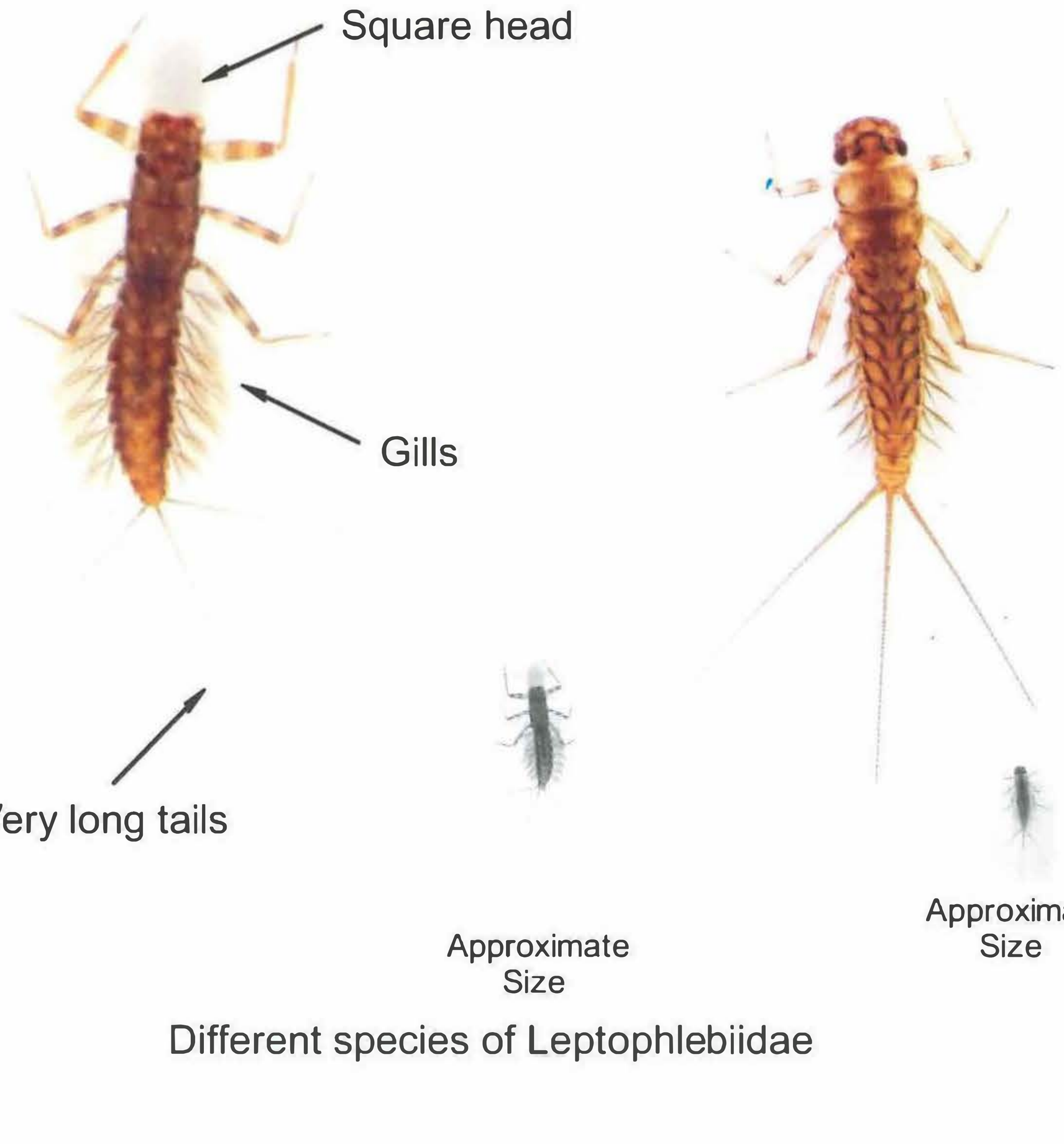
- Stones or submerged pieces of wood
- Gentle flowing streams

Colour

- Dark brown

Sensitivity

1 5 10 15



Different species of Leptophlebiidae

Family name : Oligoneuridae

Common name : *Brushlegged mayfly*

Structure

- Large nymphs
- Pointed heads
- Long tufts of hair on the forelegs
- Large, leaf-shaped gills on the sides

Behaviour

- Swift running over the substrate

Habitat

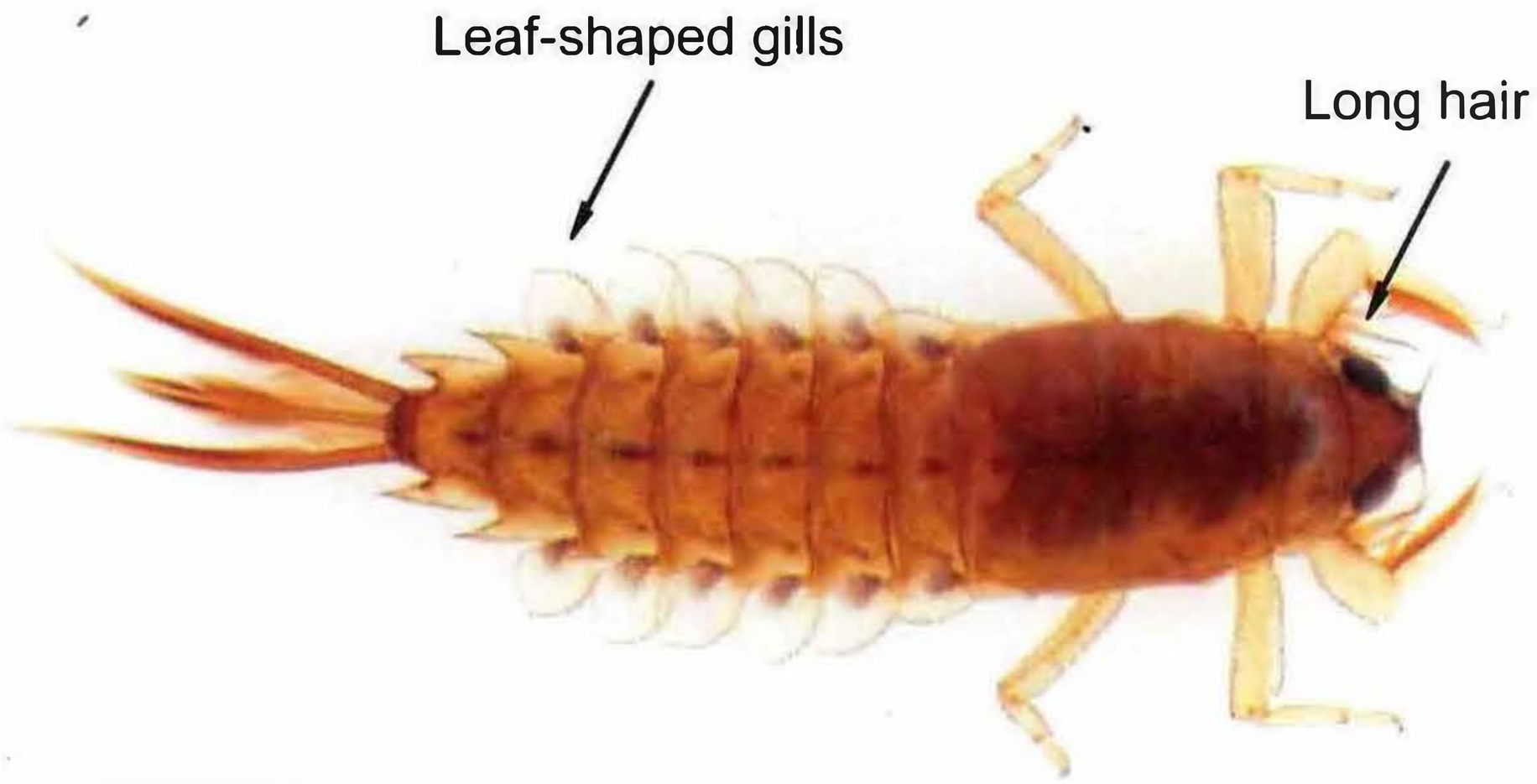
- Coarse sand or sandy patches
- Very fast flowing streams

Colour

- Brown

Sensitivity

1 5 10 15



Approximate Size

Oligoneuridae nymph

Family name : Polymitarcyidae

Common name : *Pale burrowers*

Structure

- Very prominent mouthparts
- Legs are adapted for digging into riverbanks
- Long wavy gills on both sides of the abdomen

Behaviour

- Sits quietly inside a burrow
- Active waving of the gills when at rest

Habitat

- Muddy riverbanks
- Moderately fast flowing streams

Colour

- Cream or pale brown

Sensitivity

Approximate Size

Polymitarcyidae nymph

Family name : Prosopistomatidae

Common name : *Water specs*

Structure

- Bodies oval-shaped , very flat
- Short stubby tail
- Two very small eyes
- No legs visible

Behaviour

- Active swimming

Habitat

- Stones or any floating substrate
- Fast flowing streams

Colour

- Pale to dark brown

Sensitivity

1 5 10 15

Stubby tail

Approximate Size

Prosopistomatidae nymph

Family name : Teloganodidae

SWC

Common name : *Spiny crawlers*

Structure

- A well built upper body
- Eyes are set to the side of the head
- Some species have muscular legs
- Two large round gills visible on the abdomen

Behaviour

- Crawling slowly
- Swimming in a jerky fashion

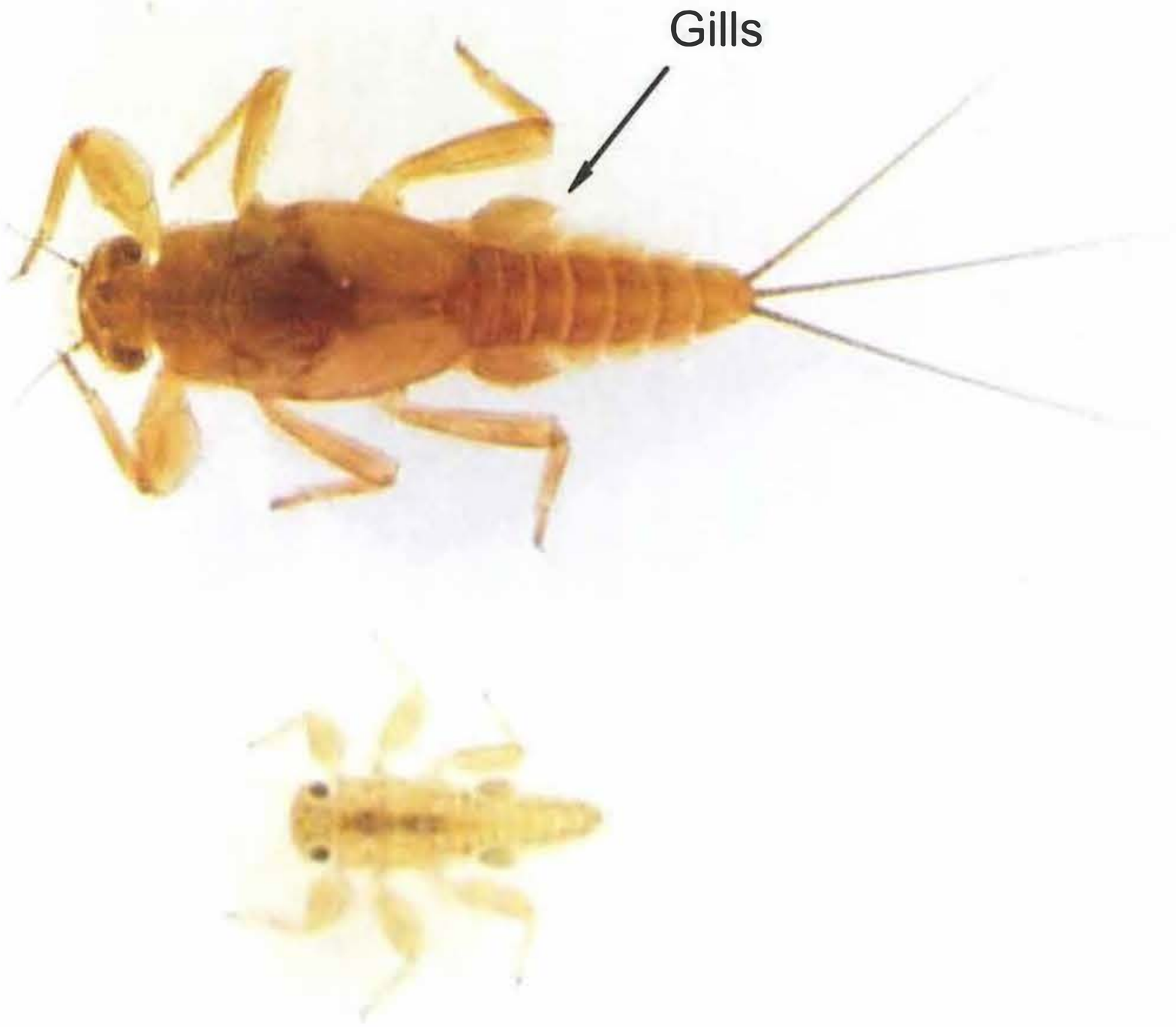
Habitat

- Stones or dense vegetation
- Fast streams in Southern and Eastern Cape

Colour

- Pale, brown, dark brown or speckled

Sensitivity



Approximate Size

Different species of Teloganodidae

Family name : Tricorythidae

Common name : *Stout crawlers*

Structure

- A muscular upper body
- Strong muscular legs
- Brush-like mouthparts
- Large eyes

Behaviour

- Clambering over substrate
- The three tails tilt upwards when at rest
- Swimming is a convulsive upwards movement, followed by falling down with body in vertical position, legs extending to the front

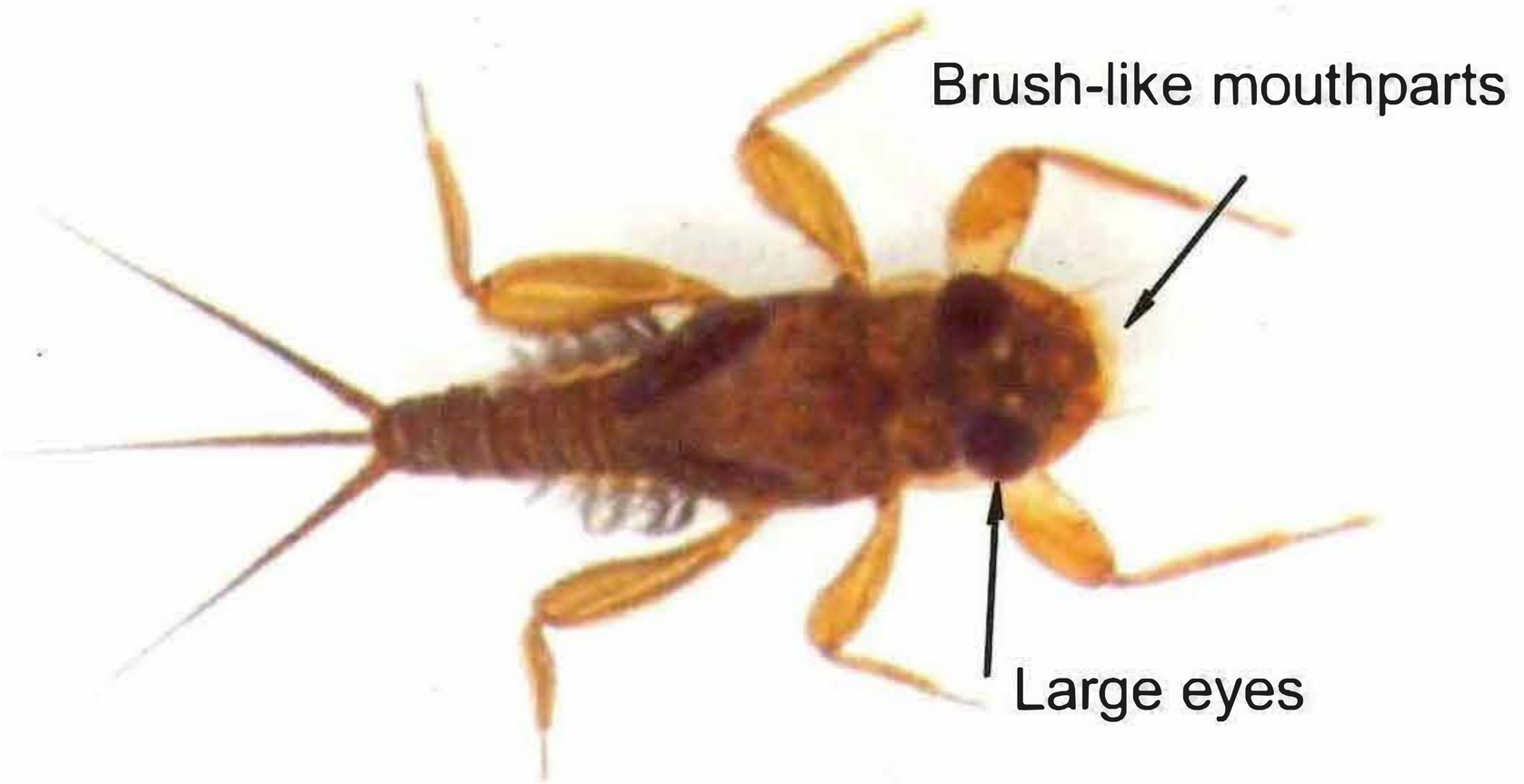
Habitat

- Rocks or any solid submerged substrate
- Fast flowing streams

Colour

- Dark brown

Sensitivity



Approximate Size

Tricorythidae nymph

ORDER : TRICHOPTERA
Caddisflies

Caddisfly larvae can be divided in two categories, namely: the portable case-building type (cased caddisflies) and the type that construct non-portable shelters (case-less or free living caddisflies).
In both instances the characteristic elongated soft body with finger-like gills on the abdomen and anal appendages are seen with which it anchor itself either to the case or to the substrate.
Three pairs of legs extend from three segments behind the head. Depending on the family, one or all of these segments are hardened.

The cased caddisflies construct cases from sand grains, bits of vegetation or silk that are glued together to form a characteristic case shape. The animals stay inside the cases from larval stage through to pupal stage. Most of the case-building types cannot swim, with the exception of the family Leptoceridae where the legs are adapted for swimming.

The final instar larvae of the free living types build special pupal cases, generally made from silk and sand or stone fragments, and which are firmly cemented to the substrate. A fine net is attached to the case to catch food particles. Free living larvae can move around by flicking the abdomen from side to side.

Caddisflies spend most of their time in the water in the larval form, after which the pupal stage follows, lasting for about two weeks.

Caddisfly larva

The adults that emerge are small moth-like insects that will live for approximately one month. Adult females are sometimes found under stones when they go under the water to lay eggs.

Caddisfly pupa

Adult caddisfly

Family name : Ecnomidae

Common name : *Caseless caddisflies*

Structure

- Soft, smooth body
- No gills on the sides
- Distinctive pattern on the head
- Three hardened segments behind the head

Behaviour

- Active crawling
- Active flicking of the abdomen when floating

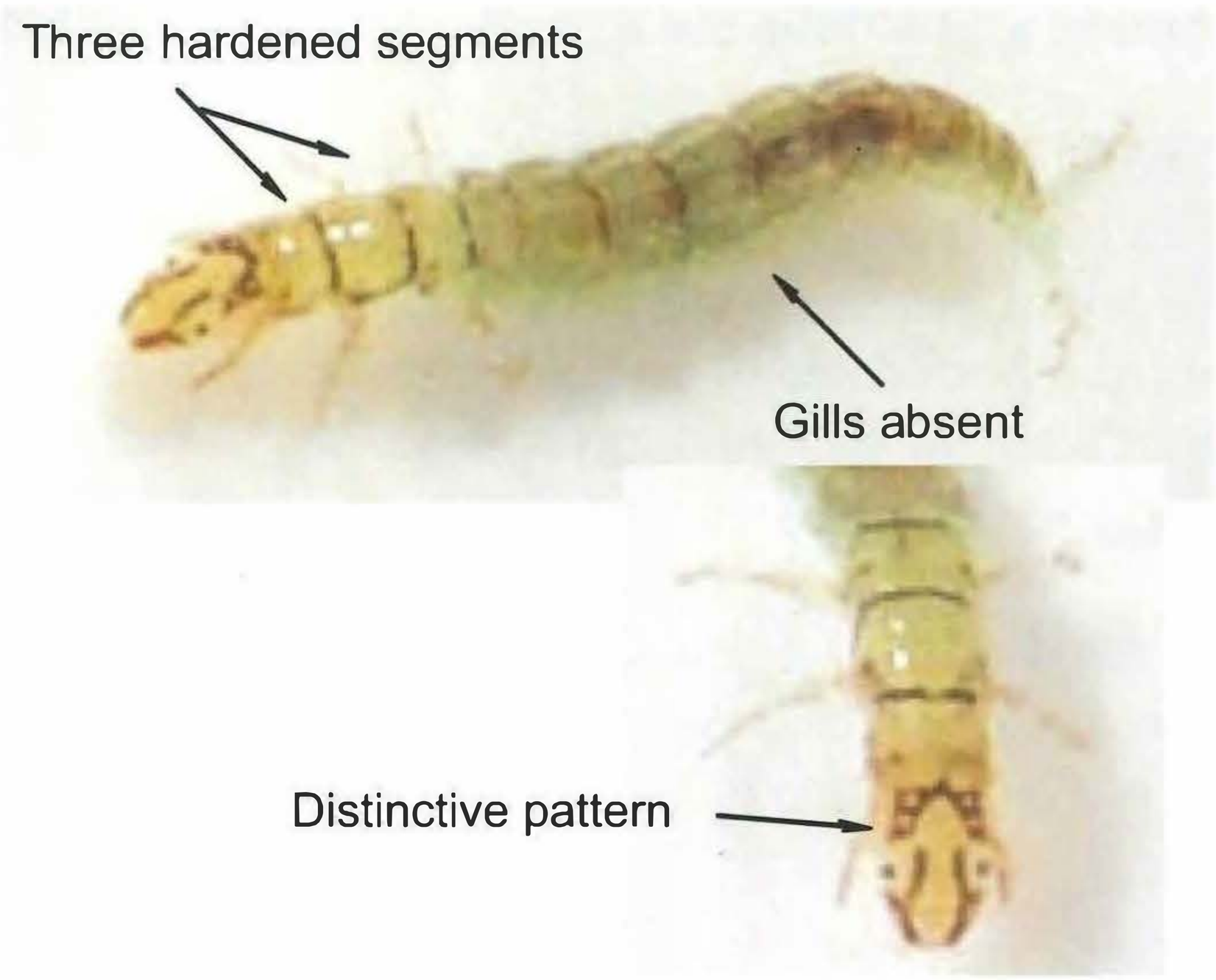
Habitat

- Stones, submerged aquatic vegetation
- Slow streams
- Quiet pools

Colour

- Cream , greenish

Sensitivity



Ecnomidae larva

Approximate Size

Family name : Ecnomidae

Genus : **Parecnomina**

Structure

- Soft, smooth body
- No gills on the sides
- Distinctive segment behind the head
- Could be mistaken for Psychomyiidae

Behaviour

- Crawling
- Floats on the surface when disturbed

Habitat

- Silk tunnels under stones
- Head waters of streams

Colour

- Grey with blue or green

Sensitivity

1 5 10 15

Approximate Size

Parecnomina larva

Family name : Polycentropodidae

Common name : *Caseless caddisflies*

Structure

- Broad body
- First segment behind head hardened
- Black hair on legs
- Characteristic protuberances where legs join body
- Characteristic pattern on the head

Behaviour

- Crawling

Habitat

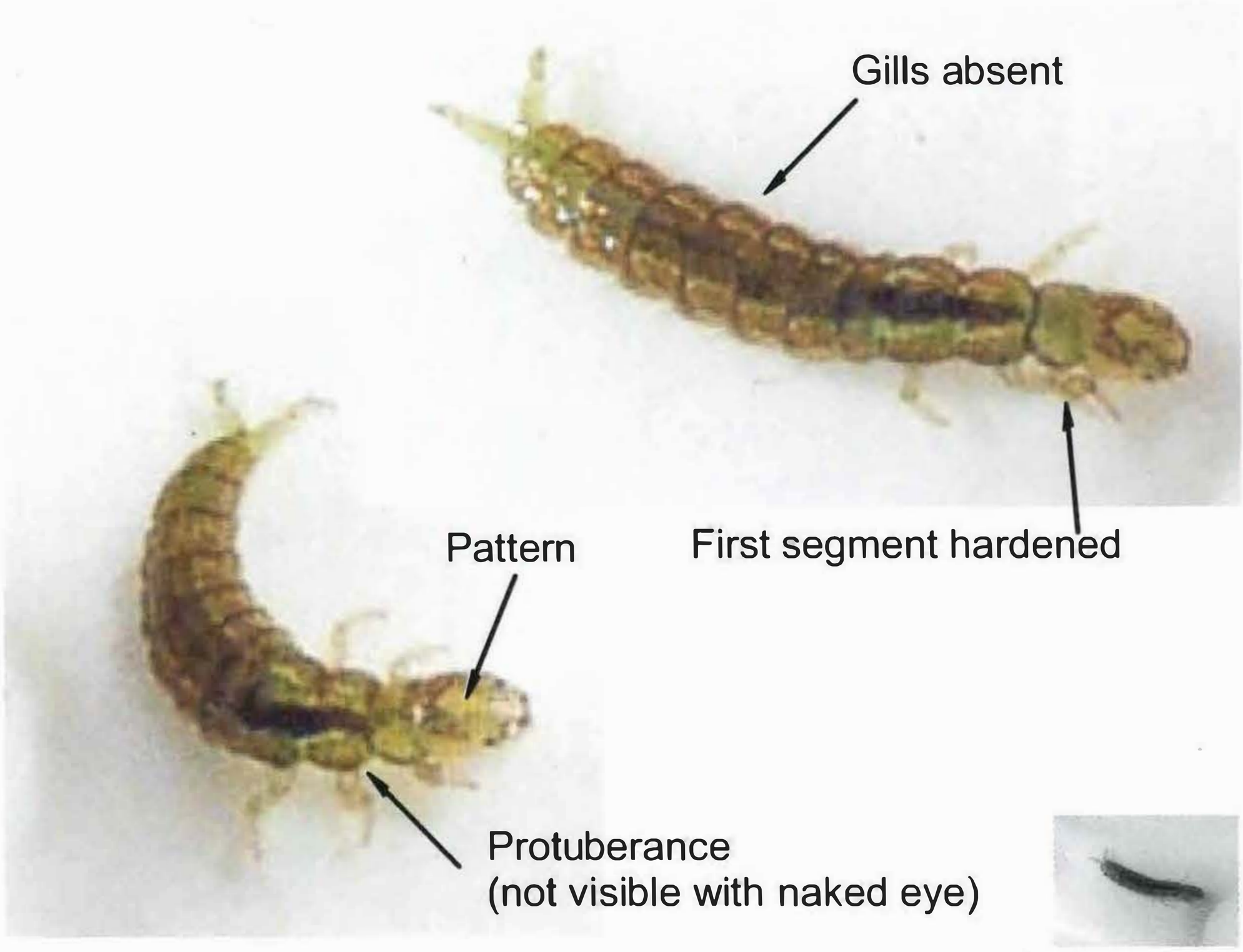
- Silken nets on stones
- Fast flowing water

Colour

- Greenish

Sensitivity

1 5 10 15



Polycentropodidae larva

Family name : Hydropsychidae

Common name : *Caseless caddisflies*

Structure

- Long slender body
- Tufts of gills on both sides of the body
- Two claws on last body segment
- Distinctive patterns or colorations on the head are usefull for identification purposes (see page 44, 45)

Behaviour

- Crawling, using legs and claws on last segment
- Float about in vertical position while abdomen is flicked from side to side

Habitat

- Under stones, living in shelters made of sand grains
- Fast flowing rivers

Colour

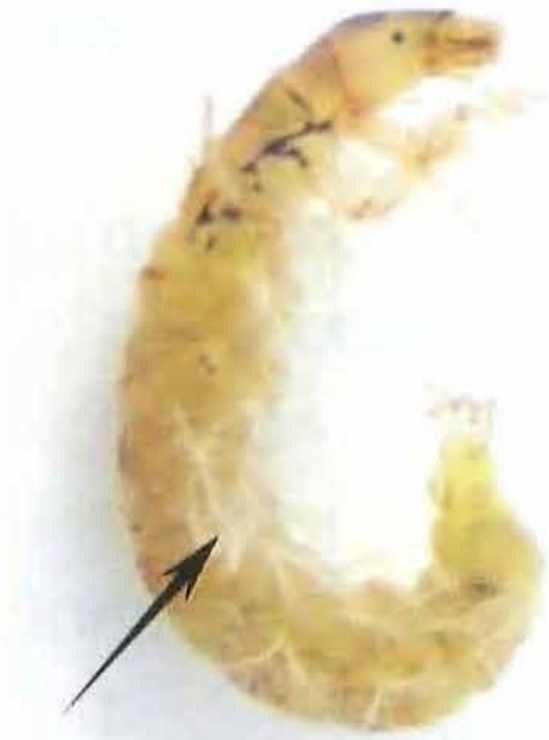
- Pale, green or brown

Sensitivity

1 — 5 — 10 — 15

Approximate Size

Hydropsychidae larva



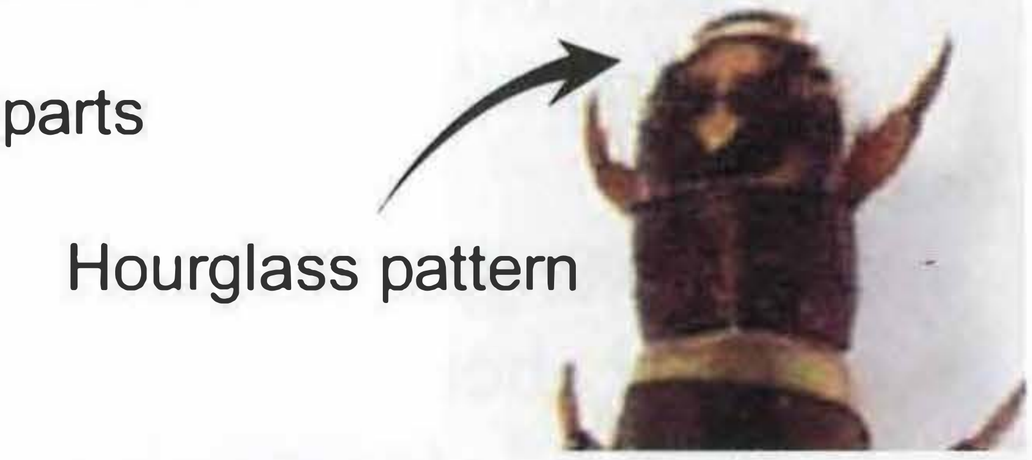
Long tufted gills

Head pale with faint pattern

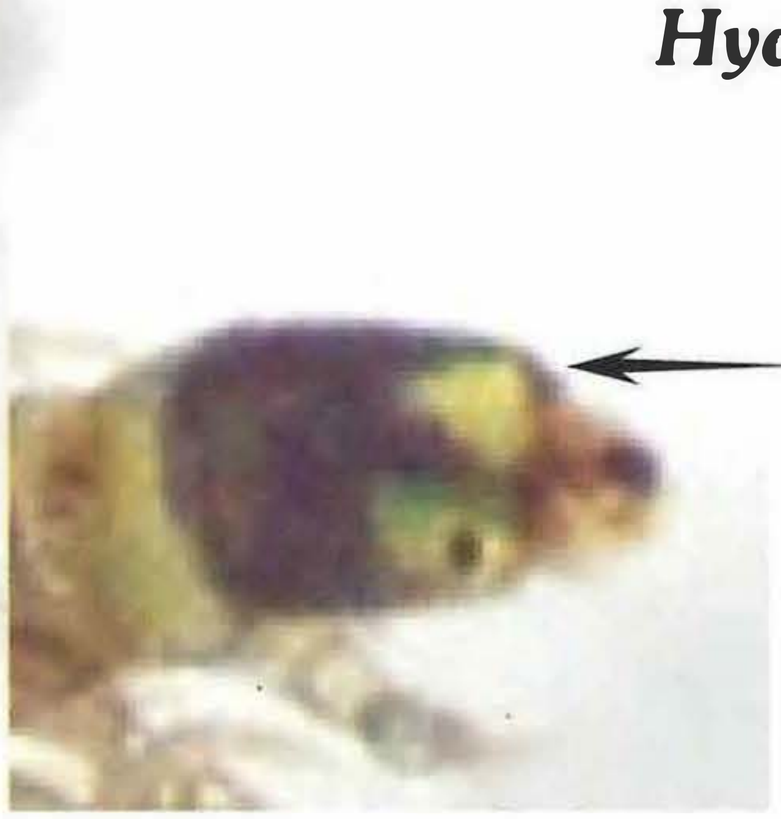
Large mouthparts

Aethaloptera maxima

Hourglass pattern

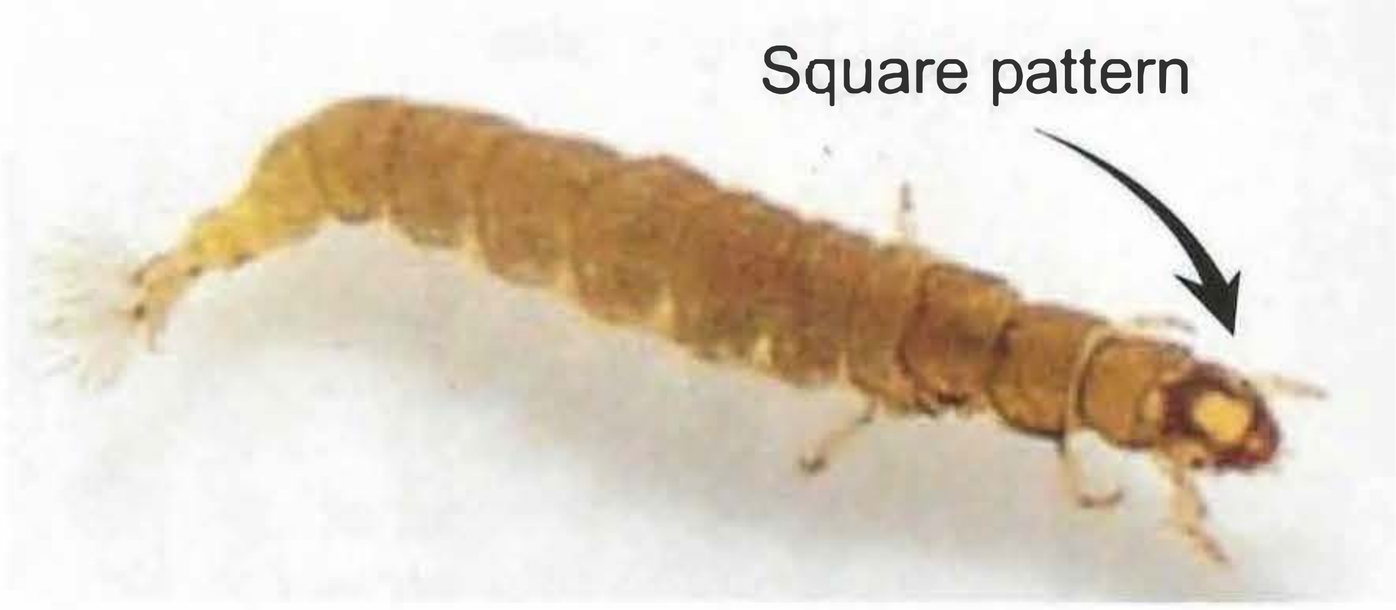


Hydropsyche sp.



Triangular pattern

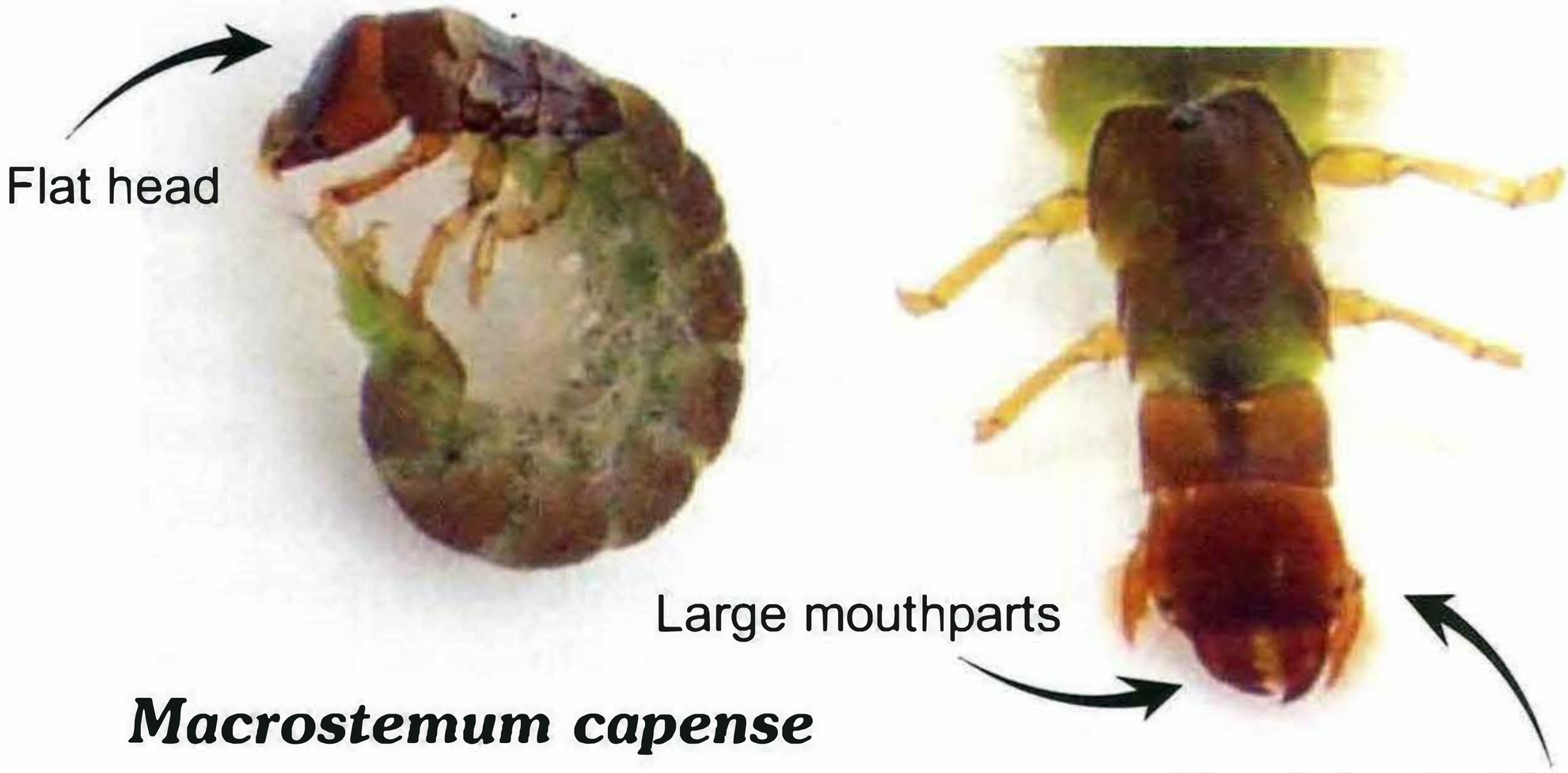
Cheumatopsyche afra type



Square pattern

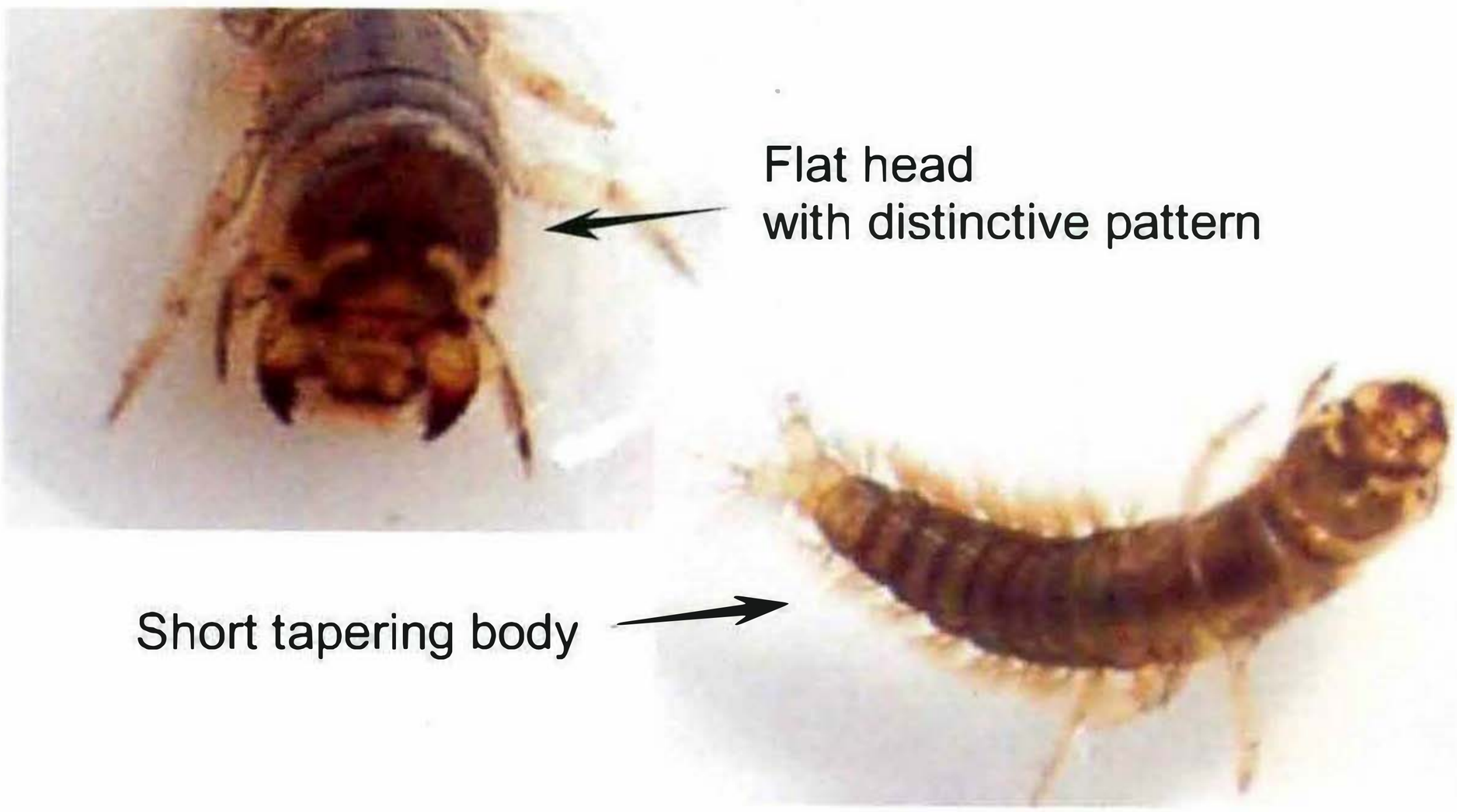
Cheumatopsyche thomasetti type

A selection of Hydropsychidae larvae



Macrostemum capense

Polymorphanisus bipunctatus



Amphisyche scottae

Family name : Philopotamidae

Common name : *Caseless caddisflies*

Structure

- Large head with well developed mouthparts
- Soft white labrum visible when extended
- Soft bodies, brightly colored
- No gills on the sides

Behaviour

- A fast, vicious twitching of the body
- Crawling backwards when held in the hand

Habitat

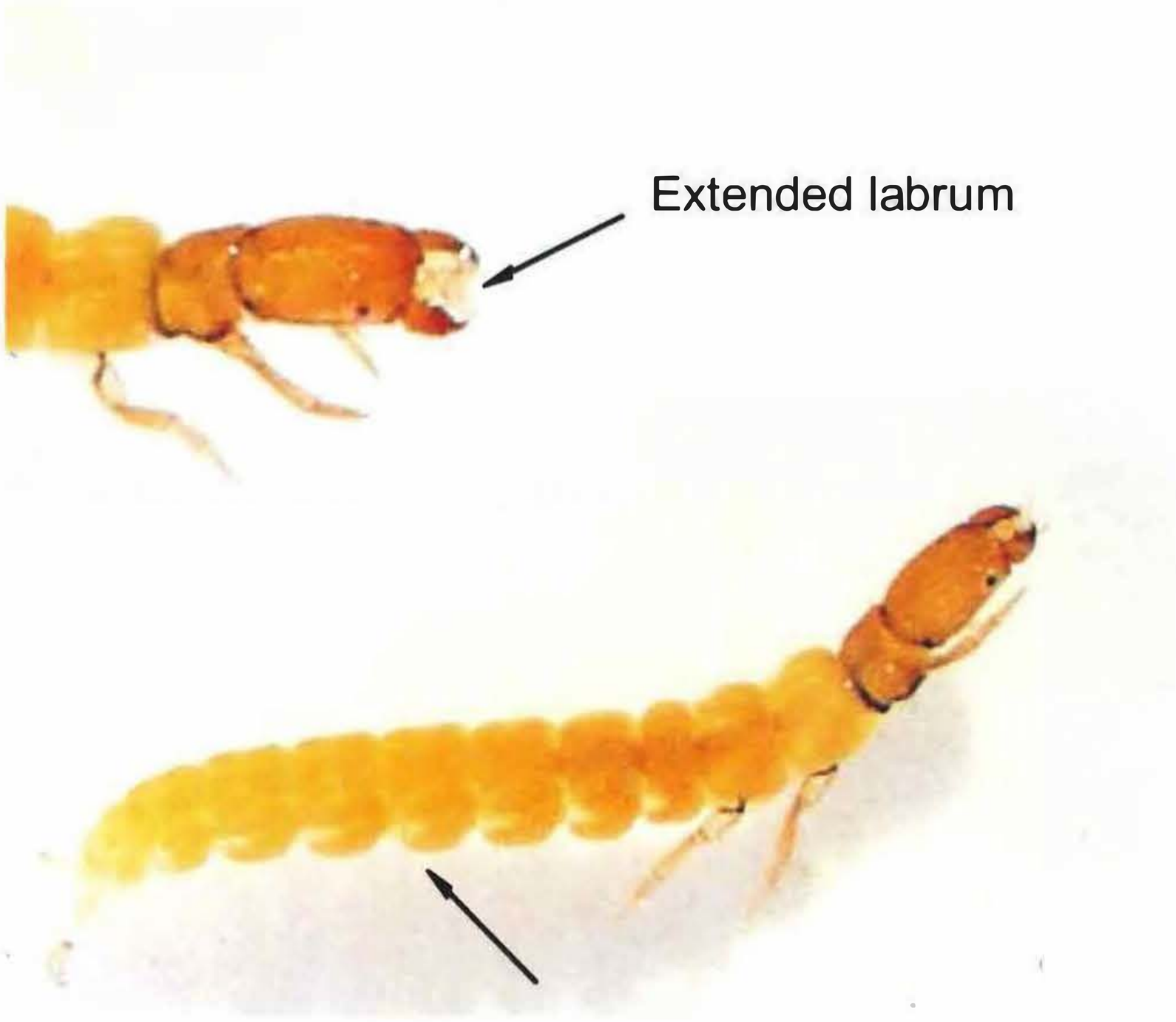
- Narrow silken tubes under stones
- Fast flowing streams

Colour

- Cream, yellow or orange

Sensitivity

1 5 10 15



Approximate Size

Philopotamidae larva

Family name : Psychomyiidae

Common name : *Caseless caddisflies*

Structure

- Soft, smooth body
- No gills on the sides

Behaviour

- Crawling
- Floats on the surface with body curled up when disturbed

Habitat

- Silk tunnels under stones
- On wet rocks around waterfalls
- Head waters of streams

Colour

- Grey, blue, green

Sensitivity

Approximate Size

Psychomyiidae larva

Family name : Barbarochthonidae

SWC

Common name : *Cased caddisflies*

Structure

- Cases are long, slender and slightly curved
- Constructed from silk
- Ornamented with minute sand grains

Behaviour

- Very active crawling

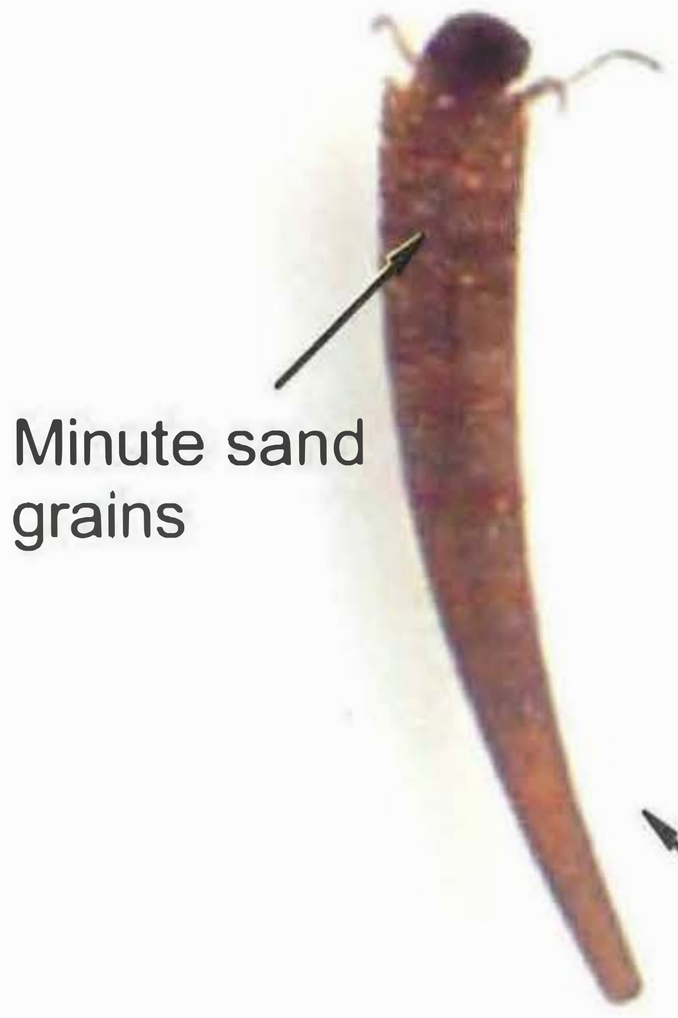
Habitat

- Stones and vegetation
- Clear, acid mountain streams of Western and Southern Cape

Colour

- Dark brown

Sensitivity



Typical gathering of Barbarochthonids on a rock

Approximate Size

Family name : Glossosomatidae

SWC

Common name : Cased caddisflies

Structure

- Cases made from small stones
- Stones bundled together to form a neat heap
- Two openings - one for the head and one to the rear for the two anal claws

Behaviour

- Very slow crawling

Habitat

- On or under stones
- Clear, acid mountain streams of Western and Southern Cape

Colour

- White to brown, depending on type of stone used

Sensitivity

1 5 10 15

Approximate Size

Family name : Hydroptilidae

Common name : *Micro caddisflies*

Structure

- Cases are constructed from silk or very fine sand with vegetable matter
- Oval, bottle-shaped or cylindrical
- Open on both ends
- Anchored to substrate by means of silk threads or anchoring discs

Behaviour

- Not active

Habitat

- On or under stones
- Slow to very slow flowing streams

Colour

- Pale, brown or green

Sensitivity

1 5 10 15

Approximate Size

Approximate Size

Family name : Pisuliidae

Common name : *Cased caddisflies*

Structure

- Fairly large, solid case
- Constructed from large bits of leaves
- No swimming hair on legs

Behaviour

- Active crawling

Habitat

- Leaf pockets
- Streams with overhanging trees
- Slow moving streams, backwaters or fast streams with areas where dead leaves gather

Colour

- Dark brown

Sensitivity

1 5 10 15

Approximate Size

Swimming hair absent

Pisuliidae

Family name : Leptoceridae

Common name : *Cased caddisflies*

Structure

- Cases straight or curved
- Constructed from plant material, silk or sand
- Long swimming legs, densely fringed

Behaviour

- Active swimming
- Resembles swimming sticks

Habitat

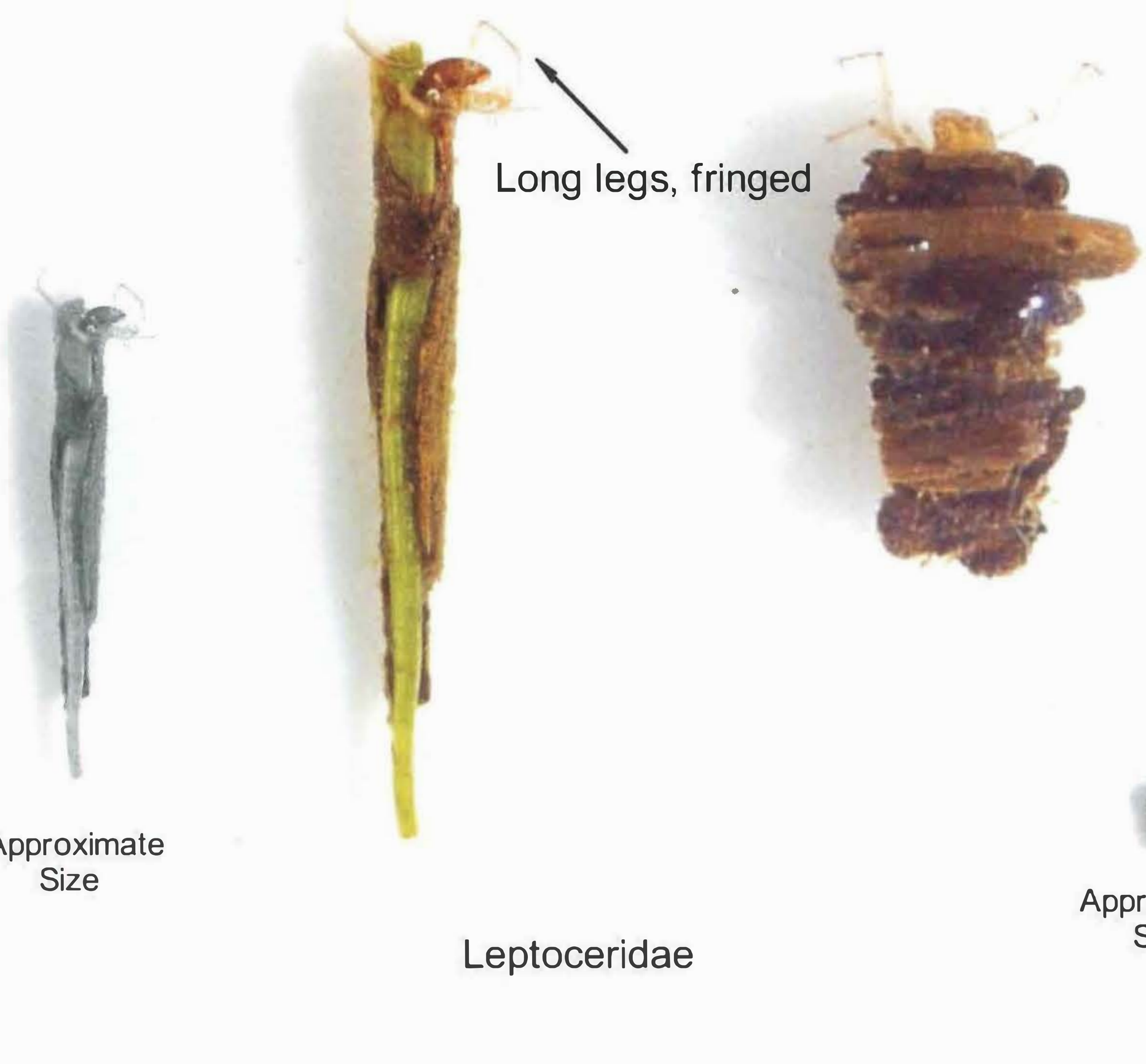
- Amongst vegetation
- Acid streams of Western and Southern Cape
- Any stream with low pH

Colour

- Shades of brown or green

Sensitivity

1 5 10 15



Silk lining inside the case

Naked Leptoceridae

A selection of different Leptoceridae cases

Family name : Petrothrincidae

SWC

Common name : *Cased caddisflies*

Structure

- Cases shield-like, flattened with a small pocket underneath
- Constructed from sand grains

Behaviour

- Crawling slowly
- Larvae not visible unless cases are flipped over

Habitat

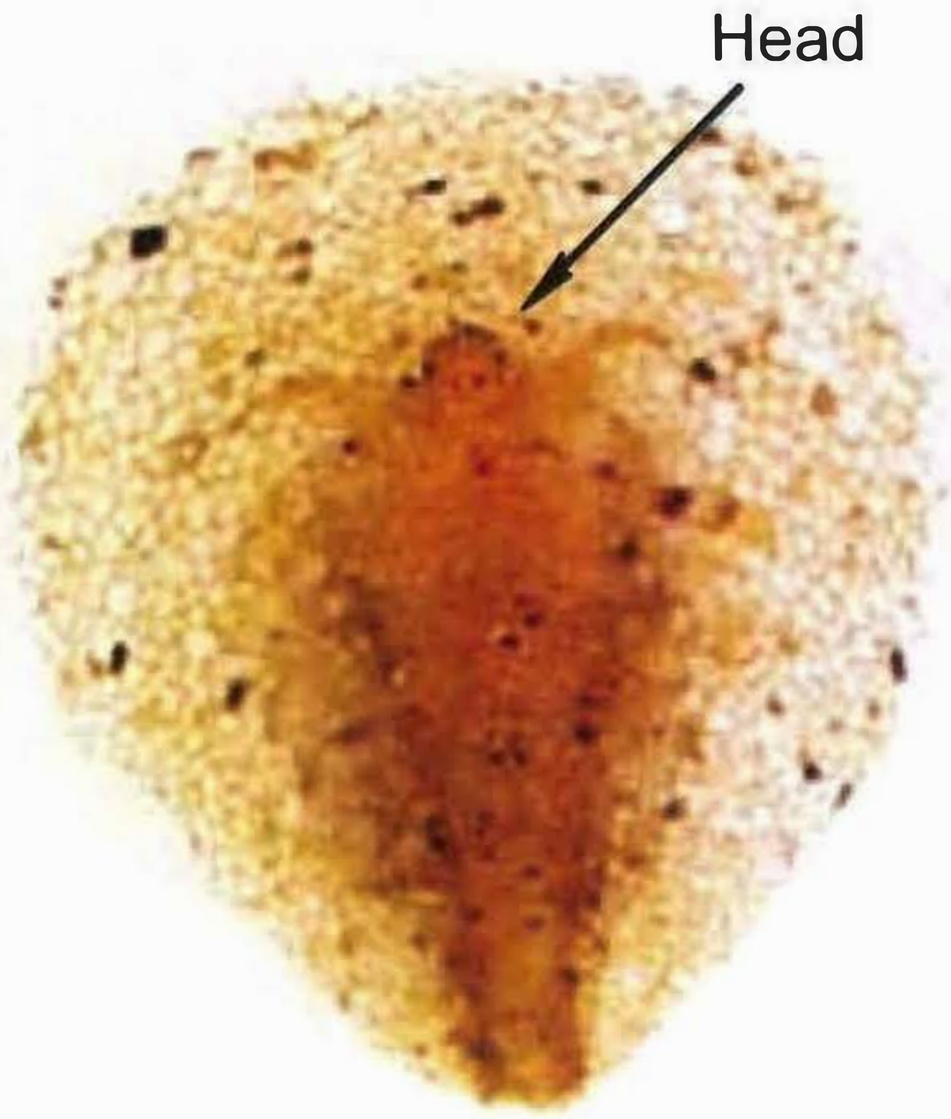
- Stones
- Acid mountain streams of Western and Southern Cape

Colour

- Pale brown

Sensitivity

1 5 10 15



Approximate Size

Family name : Sericostomatidae

SWC

Common name : *Cased caddisflies*

Structure

- Cases tubular, slightly curved
- Constructed from sand grains
- Cases ornamented with a ring of larger grains at the base

Behaviour

- Crawling

Habitat

- Vegetation or under stones
- Acid mountain streams of Western and Southern Cape

Colour

- Pale brown

Sensitivity

Approximate Size

ORDER : COLEOPTERA
Beetles

Coleoptera is the largest order of insects and certainly the group that most people are familiar with. The majority of beetles are terrestrial with the exception of a few families that are aquatic in both the adult and larval stages, while families such as Psephenidae, only have the larval stage in the water. Coleoptera occupy almost every available freshwater habitat, from mountain streams to temporary pools or the mud and sand at the edges of ponds.

Adult members of this order have an outer pair of wings that are hard and leathery and not used in flight. The soft hindwings, which are used for flight, are concealed under the outer wings when at rest

In certain families, such as Elmidae, the legs are not adapted for swimming and adult beetles crawl clumsily over substrate. Other families, such as Dytiscidae, are very good swimmers with hind legs flat and hairy to act like oars.

The majority of adult aquatic beetles need atmospheric oxygen to survive. They carry a supply in air bubbles or in the form of a thin film around the body. This film shows up as a silvery coating when the beetles are submerged.

In certain families the adult beetles are able to fly. This enables them to move to different water bodies, which they usually do at night.

Adult beetle

Beetle larvae differ considerably from the adults, not only in appearance but also in the way they move. Some swim very well while others get around with a sluggish crawl.
Some larvae also come to the surface for fresh air, while those with proper gills can remain submerged for a longer period of time.

Beetle larva

Family name : Dytiscidae - adults

Common name : *Predacious diving beetles*

Structure

- Oval shaped bodies
- Rounded backs
- Elongated hind legs with last segment flattened and fringed

Behaviour

- Fast swimming/diving using hind legs together like oars
- Resting just below water surface, head down and tip of abdomen pushing trough surface film

Habitat

- Amongst plants on the edges of ponds/pools
- Backwater areas of streams

Colour

- Black or brown
- Some species carry yellow markings

Sensitivity 1 5 10 15

Approximate Size

Approximate Size

Dytiscidae adults

Family name : Dytiscidae - larva

Common name : *Predacious diving beetles*

Structure

- Streamlined spindle-shaped bodies
- Large heads
- Well-developed mouthparts
- Fringed swimming legs

Behaviour

- Swims slowly with alternate rowing of the legs

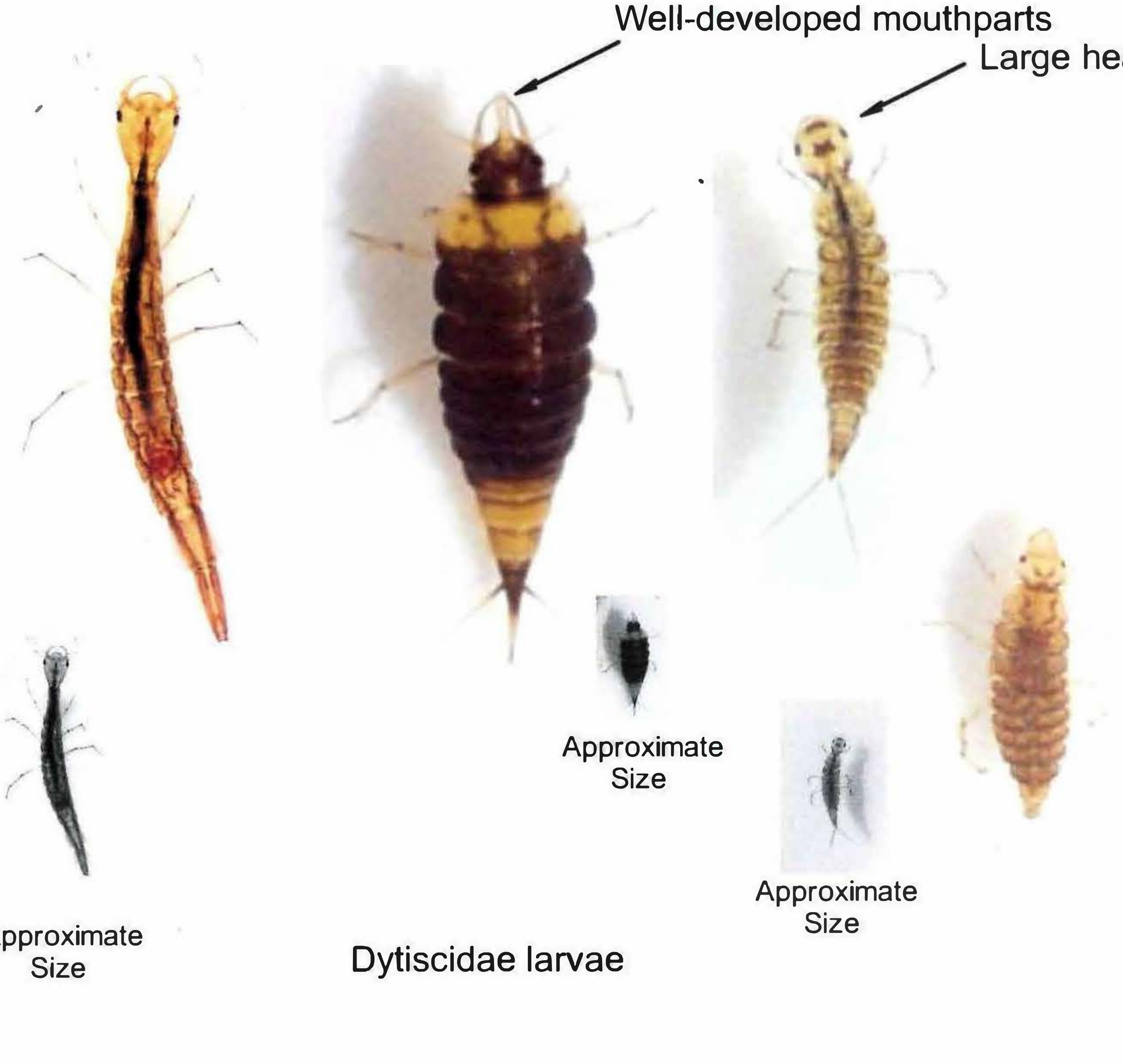
Habitat

- Amongst plants on the edges of ponds/pools
- Backwater areas of streams

Colour

- Pale, light brown or dark brown

Sensitivity



Dytiscidae larvae

Family name : Elmidae - adults

Common name : *Riffle beetles*

Structure

- Very small
- Slender antennae, last segment widened in some species
- Sharp claws on the feet

Behaviour

- Very slow moving
- Walking/crawling whilst clinging to substrate with long claws

Habitat

- Stones or any solid substrate
- Fast streams

Colour

- Black
- Some species with red toes

Sensitivity

Approximate Size

Approximate Size

Elmidae adults

Family name : Elmidae - larvae

Common name : *Riffle beetles*

Structure

- Different body shapes according to species
- All body segments hardened
- Three tufts of anal gills

Behaviour

- Moves as slow as the adults
- Tufts of anal gills visible at intervals

Habitat

- Stones or any solid substrate
- Fast streams

Colour

- Cream, dark brown or reddish brown

Sensitivity

1 5 10 15

Approximate Size

Gills

Approximate Size

Approximate Size

Elmidae larvae

Family name : Gyrinidae - adults

Common name : *Whirligig beetles*

Structure

- Oval bodies, streamlined and shiny
- Hind legs fringed, flattened like paddlles
- Eyes are divided , one half can look skywards, the other half into the water

Behaviour

- Floats on the water surface in circular patterns
- Scatter or dive when disturbed
- Able to fly - they need to climb onto an emerging object in order to take off

Habitat

- On the surface of the water
- Quiet ponds or flowing water

Colour

- Charcoal with waxy appearance

Sensitivity

Gyrinidae adult

Approximate Size

Family name : Gyrinidae - larvae

Common name : *Whirligig beetles*

Structure

- Long slender body
- Feathery gills on the sides
- Four hooks on last segment of abdomen
- Well developed mouthparts

Behaviour

- Crawling on submerged vegetation or substrate
- Active swimming in a wavy, sinuous manner

Habitat

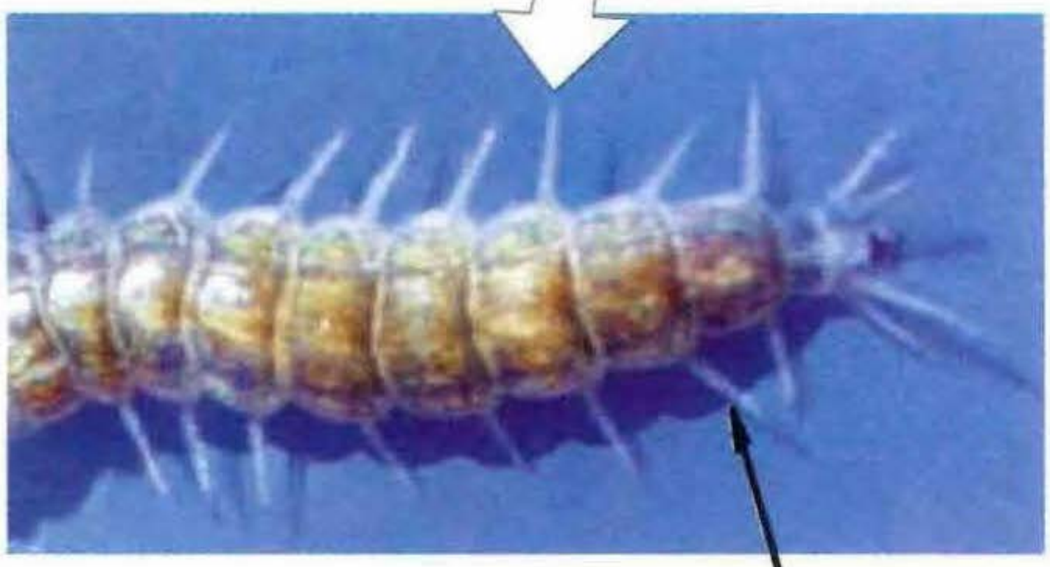
- Under stones or other solid substrate
- On vegetation
- Slow to moderately fast streams

Colour

- Pale brown

Sensitivity

Strong mouthparts



Gills

Approximate Size

Gyrinidae larva

Family name : Helodidae - larvae

Common name : *Marsh beetles*

Structure

- Small broad body, clearly segmented
- Long hair on the last segment
- Very long, thin antennae

Behaviour

- Cling to vegetation
- Move around in an awkward wriggling fashion with antenna arched side-ways

Habitat

- On submerged vegetation
- Under stones
- Slow or fast streams with low pH value

Colour

- Brown, reddish brown

Sensitivity

Helodidae adult

Approximate Size

Family name : Hydraenidae - adults

Common name : *Minute moss beetles*

Structure

- Minute in size
- Mouthparts longer than antennae
- Antennae club-shaped

Behaviour

- Active swimmers

Habitat

- Stagnant pools
- Wet rocks around waterfalls
- Amongst plants on the edge of streams

Colour

- Dark brown ,shiny

Sensitivity

1 5 10 15

Approximate Size

Hydraenidae adult

Family name : Hydrophilidae - adults

Common name : *Water scavenger beetles*

Structure

- Oval body with rounded back
- Short clubbed antennae, mostly hidden
- Mouthparts much longer than antennae

Behaviour

- Active swimming, using hind legs alternately
- They come to the surface with head first to break surface film with tip of the antenna

Habitat

- Amongst vegetation
- In muddy patches along riverbanks
- Quiet shallow pools or slow edges of streams

Colour

- Brownish or black

Sensitivity 1 5 10 15

Approximate Size

Hydrophilidae adult

Family name : Hydrophilidae - larvae

Common name : *Water scavenger beetles*

Structure

- Soft, worm-like
- Well-deveoped mouthparts

Behaviour

- Slow moving
- Creeping/crawling with head tilted upwards

Habitat

- Pools
- Quiet, shallow edges of streams

Colour

- Pale brown

Sensitivity

Well-developed mouthparts

Approximate Size

Hydrophilidae larva

Family name : Psephenidae - larvae

Common name : *Water penny beetles*

Structure

- Broad disc-like body, very flat
- Head, legs and gills not visible from above

Behaviour

- Move around in a slow gliding fashion
- Entire body acts as a sucker to cling to rocks

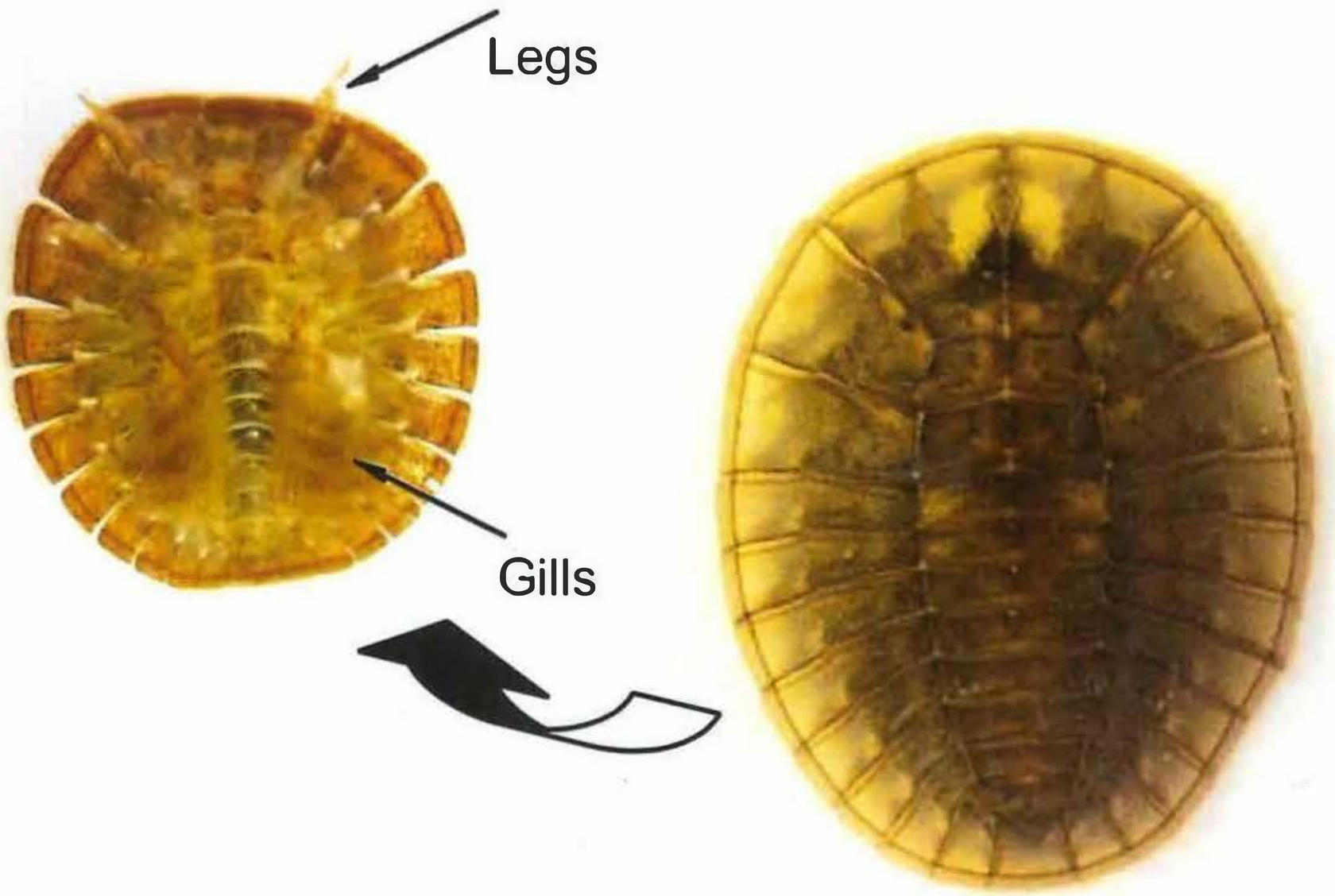
Habitat

- On rocks or other solid substrate
- Shallow fast streams

Colour

- Brown with copper tinge

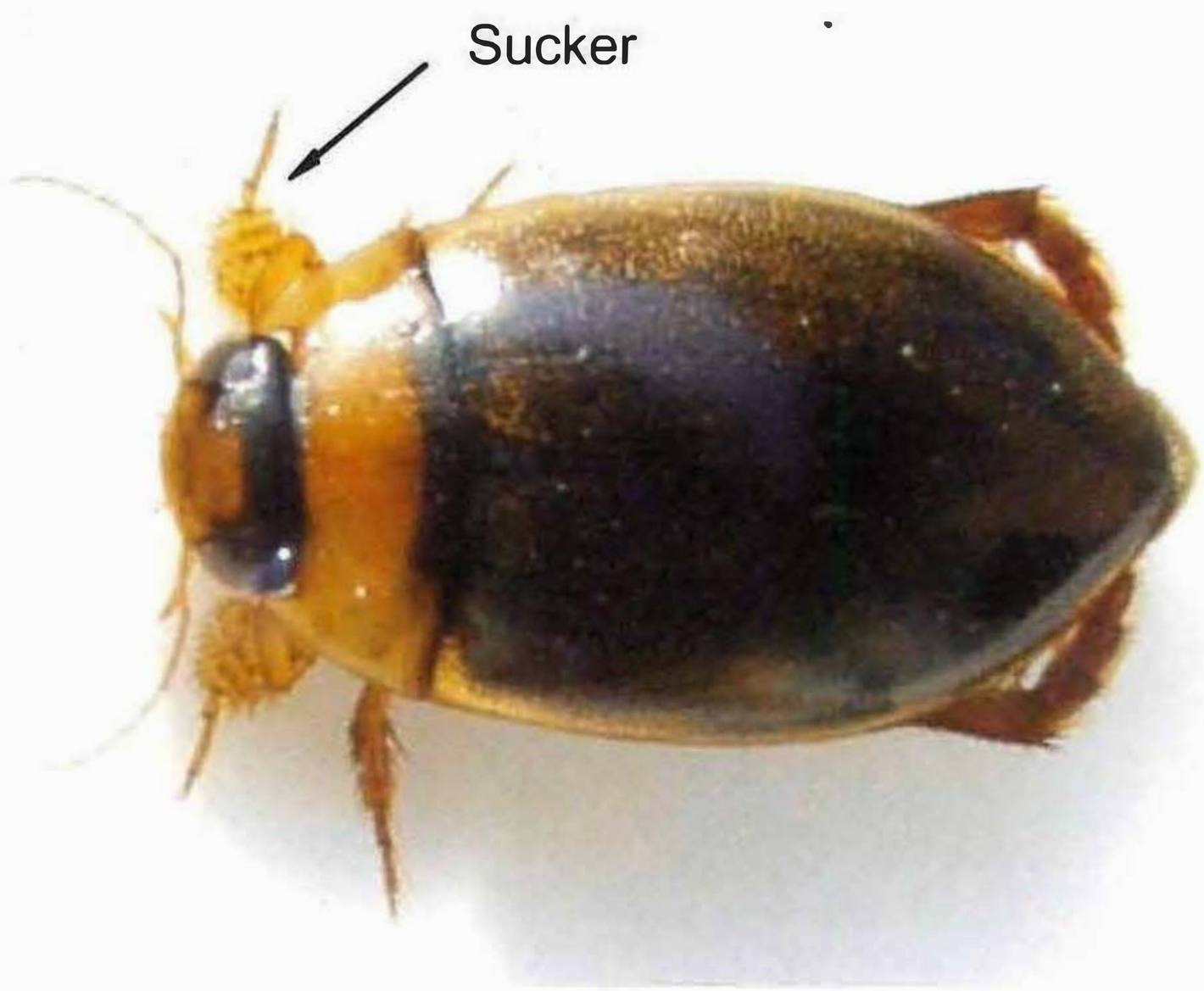
Sensitivity



Approximate Size

Psephenidae larva

Dytiscidae - the legs are well adapted for swimming and diving



Male Dytiscidae. Suckers on the front legs are used to hold the female during mating

ORDER : HEMIPTERA
True bugs

Hemiptera could be described as the order with the greatest variety of body shapes. Body size can also range from the very small Pleidae to the very large Nepidae.

Bugs can be distinguished from other insects by the mouthparts that are modified to pierce and suck. Some families protect themselves by stinging viciously when handled carelessly.
Young bugs look and behave like the adults, they are just smaller and immature.

From this large order of insects only a few families are really adapted to aquatic habitats. Nepidae and Belostomatidae can remain under water but need to be more or less in contact with the water surface film. Other families such as Veliidae, Gerridae and Hydrometridae run or float on the surface. Families such as Notonectidae and Corixidae are the best swimmers with legs adapted specifically for that purpose.

The types that stay on top of the water have the respiratory characteristics of terrestrial insects, while the ones living below the surface need to come to the surface at intervals to renew their air supply.

Adult Hemiptera

Almost all aquatic Hemiptera are predators. The forelegs are adapted to seize and hold prey while body fluids are sucked up through the mouthparts.

Belostomatidae (giant water bugs) can be important pests in fish hatcheries, since they feed on fish up to 7.5 cm long.

Family name : Belostomatidae

Common name : *Giant water bugs*

Structure

- Large, robust nymphs
- Prominent eyes
- Forelegs adapted to seize and hold prey

Behaviour

- Swim with forelegs stretched forward
- Cling to submerged substrate with tip of abdomen in contact with the air

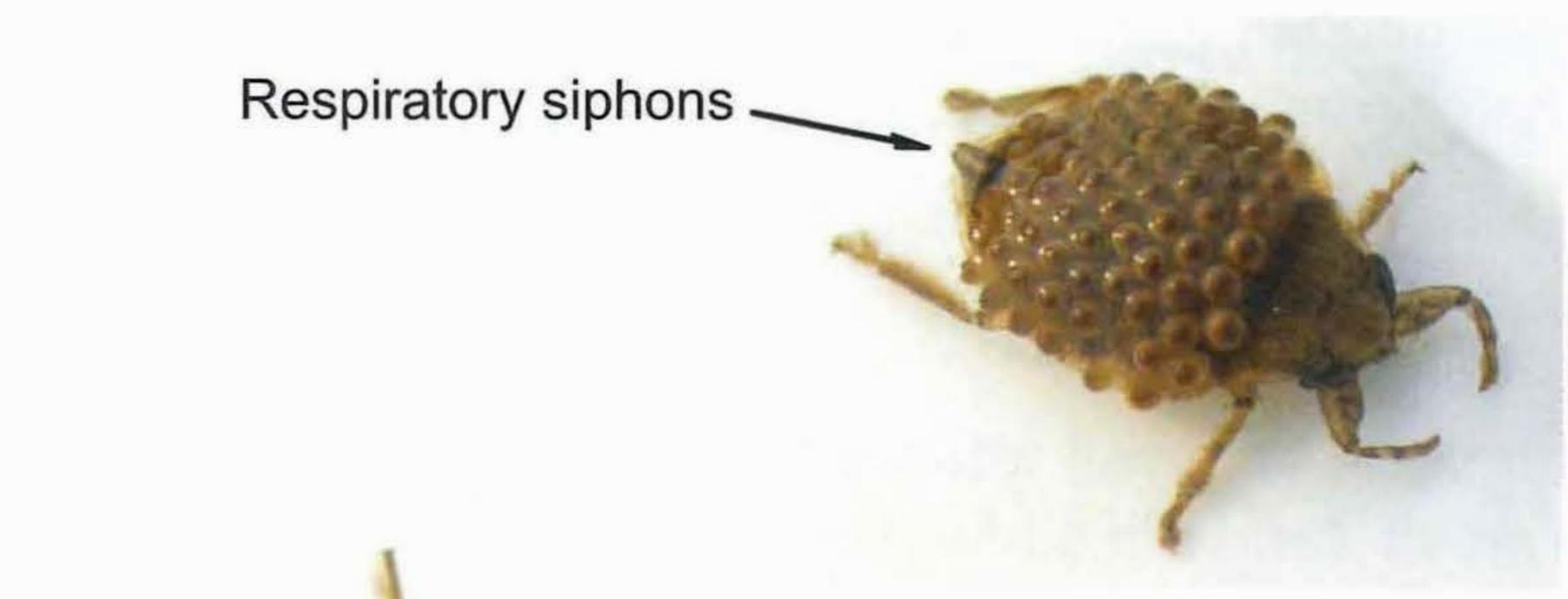
Habitat

- Bottom of shallow pools
- Backwater areas or quiet areas of streams

Colour

- Brown or dull green

Sensitivity



Male Belostomatidae carrying eggs on the back

Belostomatidae

Approximate Size

Family name : Corixidae

Common name : *Water boatmen*

Structure

- Small cigar-shaped
- Middle legs long, ending with two claws for anchoring purposes
- Hind legs long, fringed for swimming
- No extended beak, mouthparts fused with the head

Behaviour

- Swim in a quick darting fashion, rowing with the hind legs

Habitat

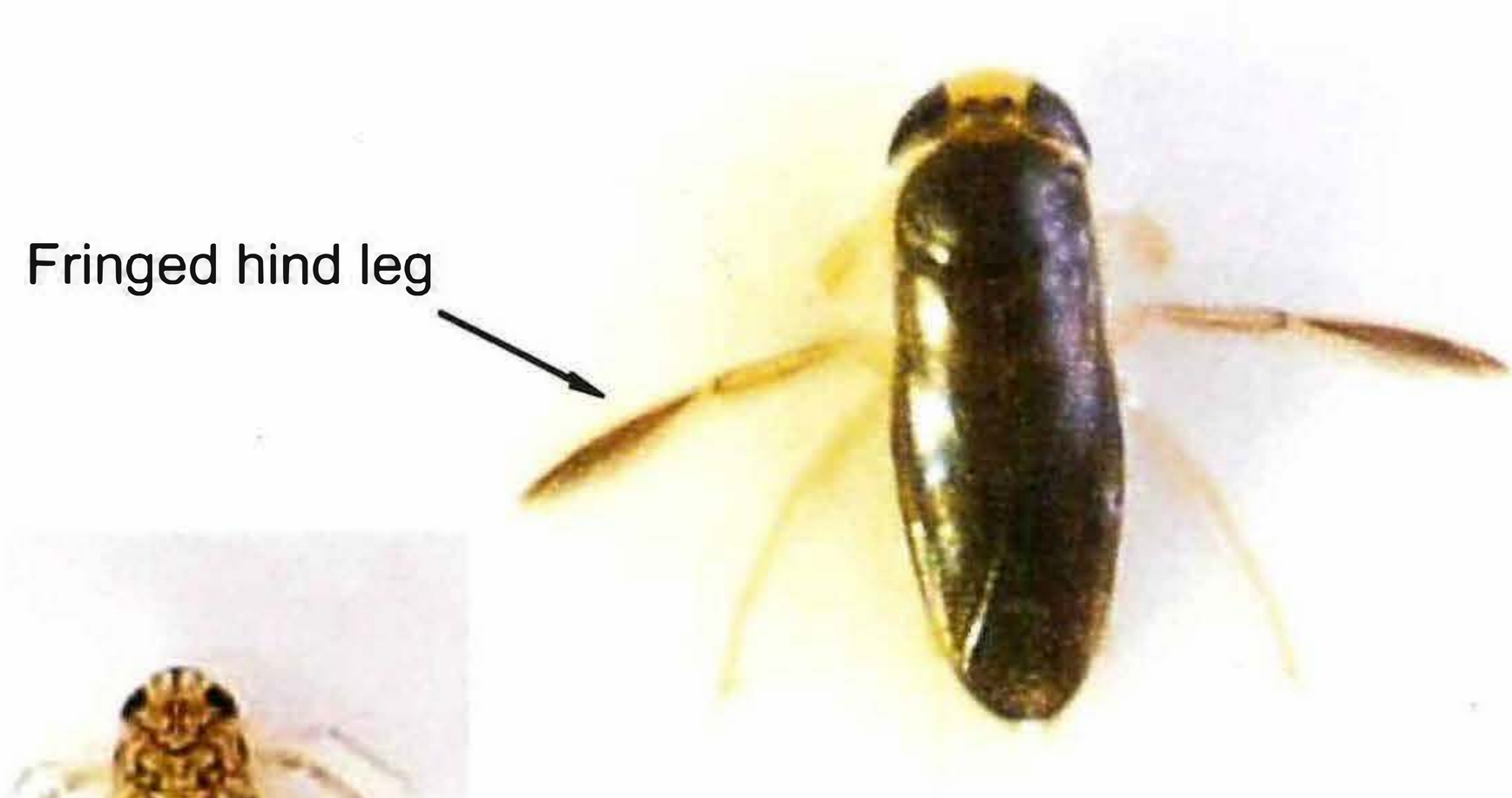
- Shallow pools
- Quiet muddy areas of streams

Colour

- Dark grey, mottled yellow, brown or black

Sensitivity

1 5 10 15



Approximate Size

Approximate Size

Family name : Gerridae

Common name : *Pond skater*

Structure

- Body form either stout or narrow
- Forelegs short, adapted for seizing prey
- Middle and hind legs thin and very long

Behaviour

- Skating or leaping on the surface film of ponds and streams

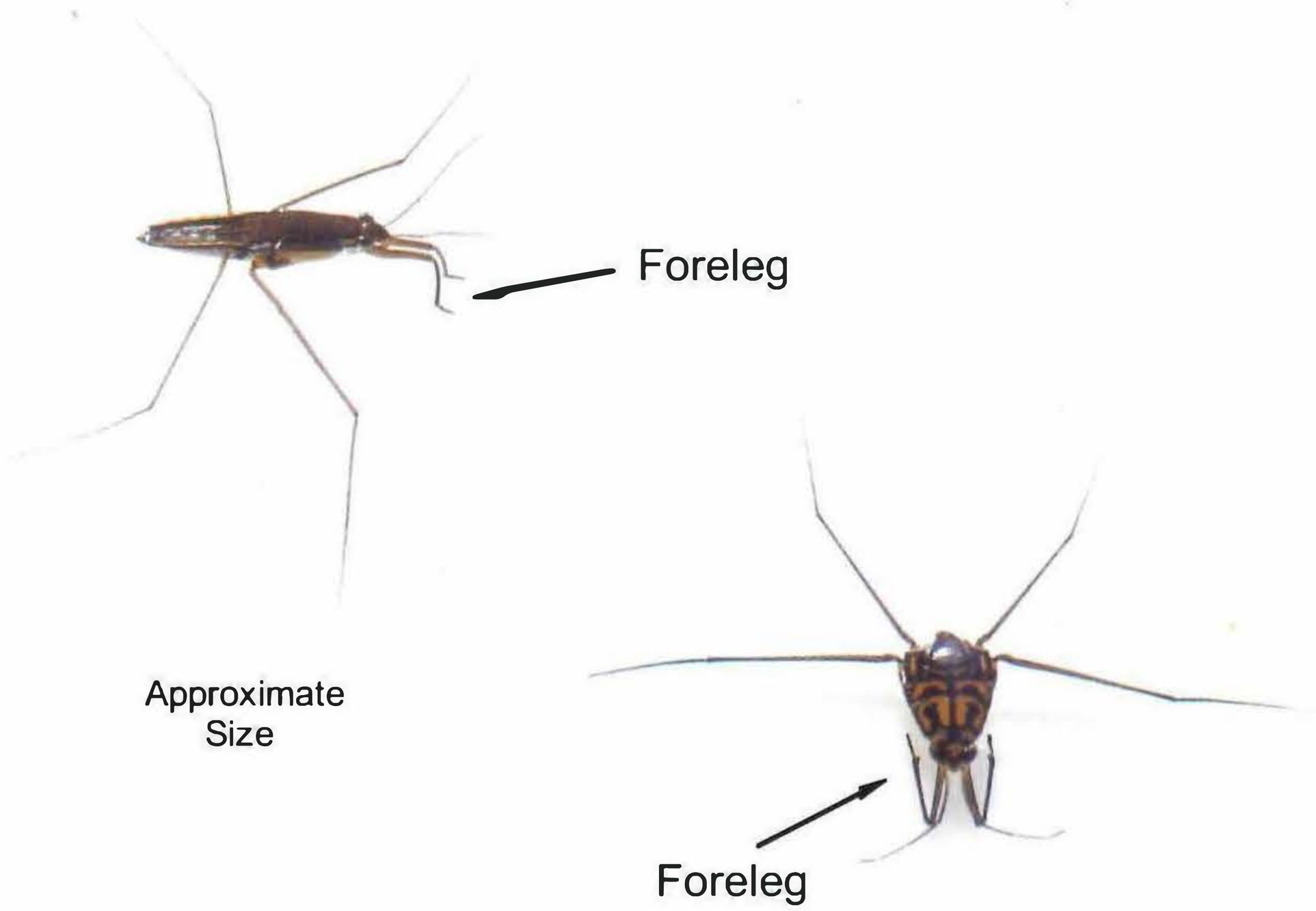
Habitat

- On surface of ponds or streams
- Shaded areas

Colour

- Dark brown

Sensitivity



Different types of Gerridae

Family name : Hydrometridae

Common name : *Marsh treaders*

Structure

- Slender stick-like bodies
- Legs and antennae very thin, frail
- Beak folds away under the head

Behaviour

- Walk about on floating vegetation
- Float around on surface of pools

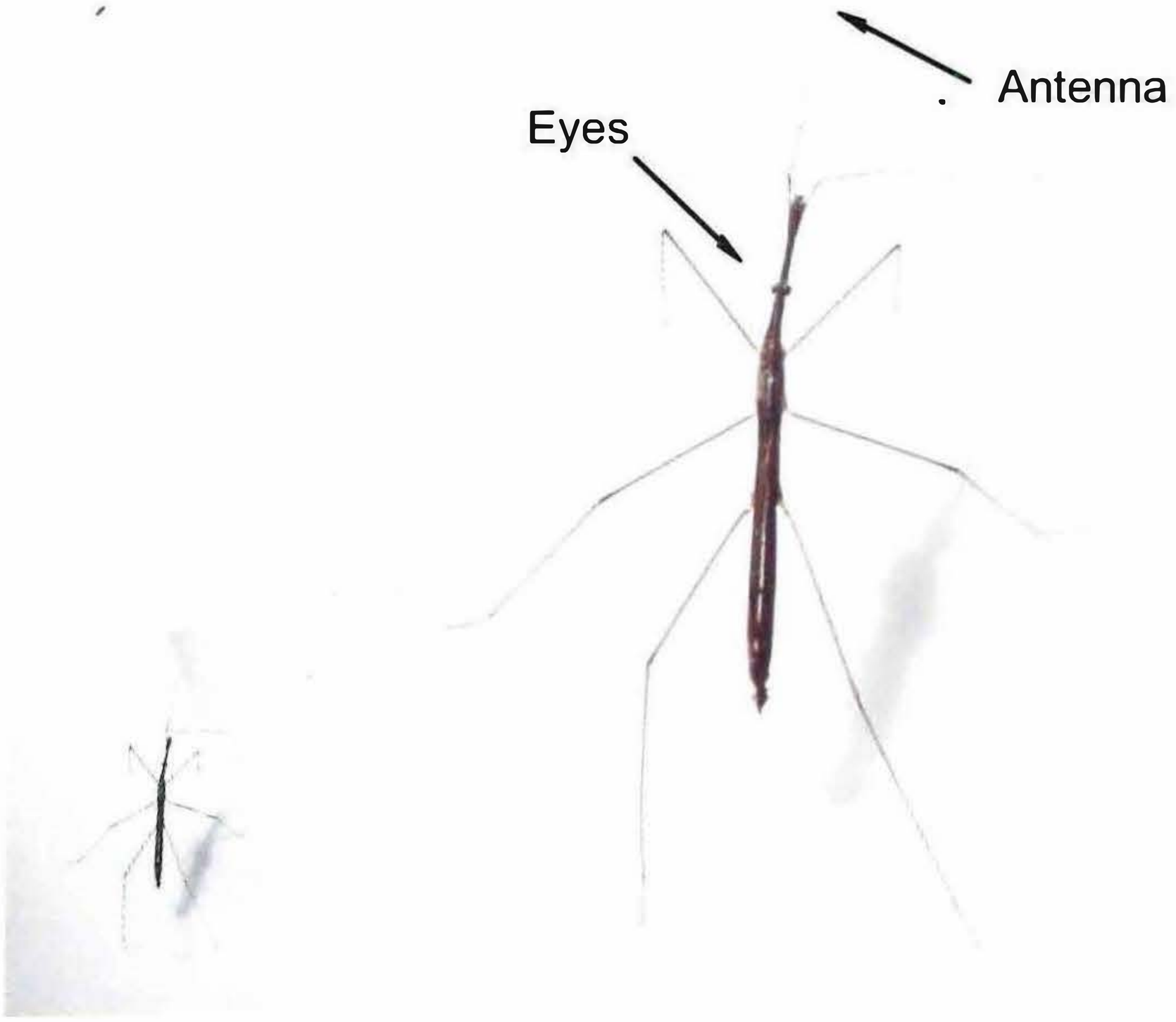
Habitat

- Floating vegetation
- Backwaters of streams

Colour

- Brown

Sensitivity



Approximate Size

Hydrometridae

Family name : Nepidae

Common name : *Water scorpions*

Structure

- Body shapes varied according to species
- Forelegs modified for seizing prey
- Long respiratory tube on tip of abdomen

Behaviour

- Swim slowly with alternating strokes of middle and hind legs
- Sit quietly amongst vegetation with forelegs in striking position

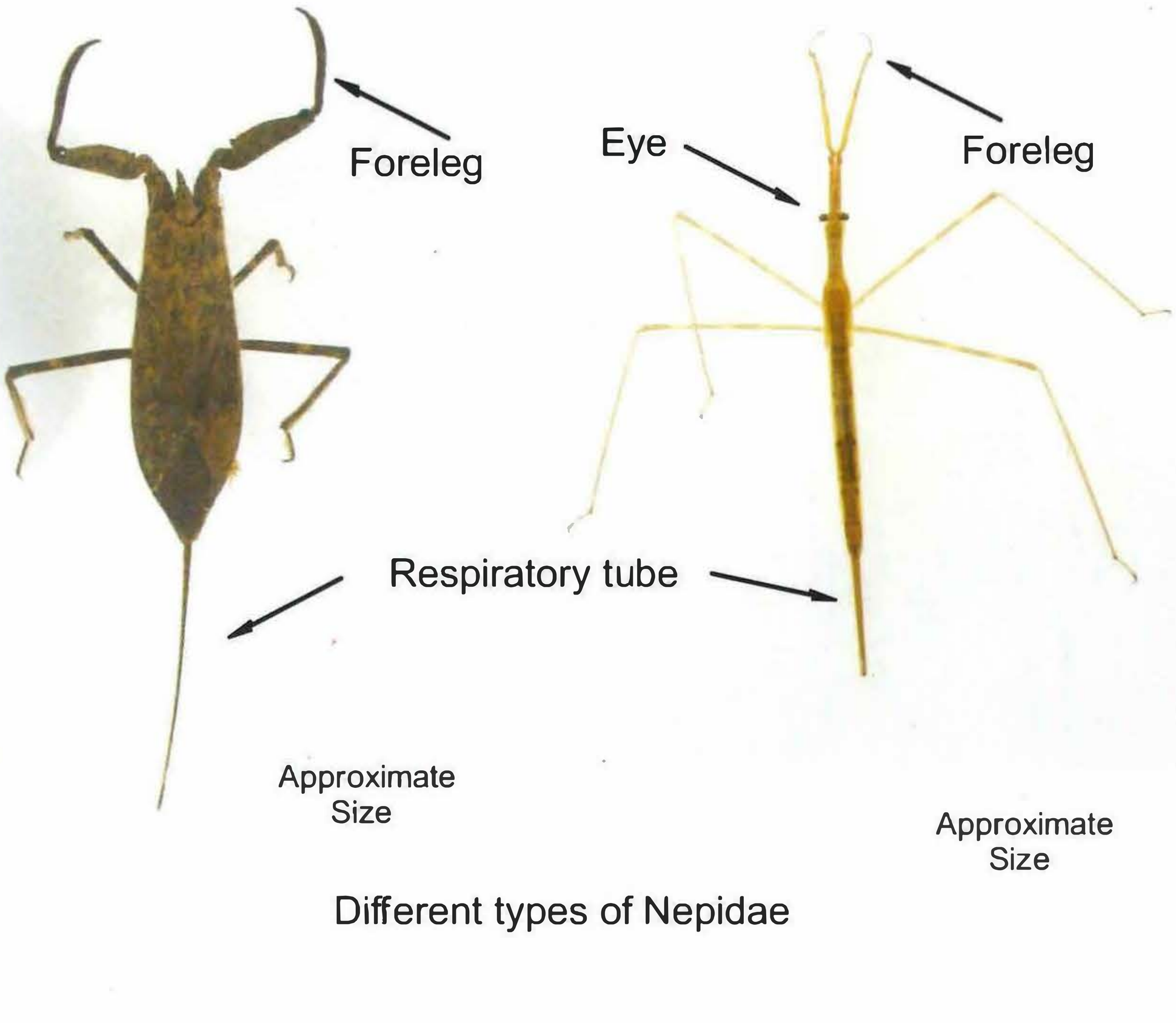
Habitat

- Vegetation, trash or mud
- Shallow pools or slow streams

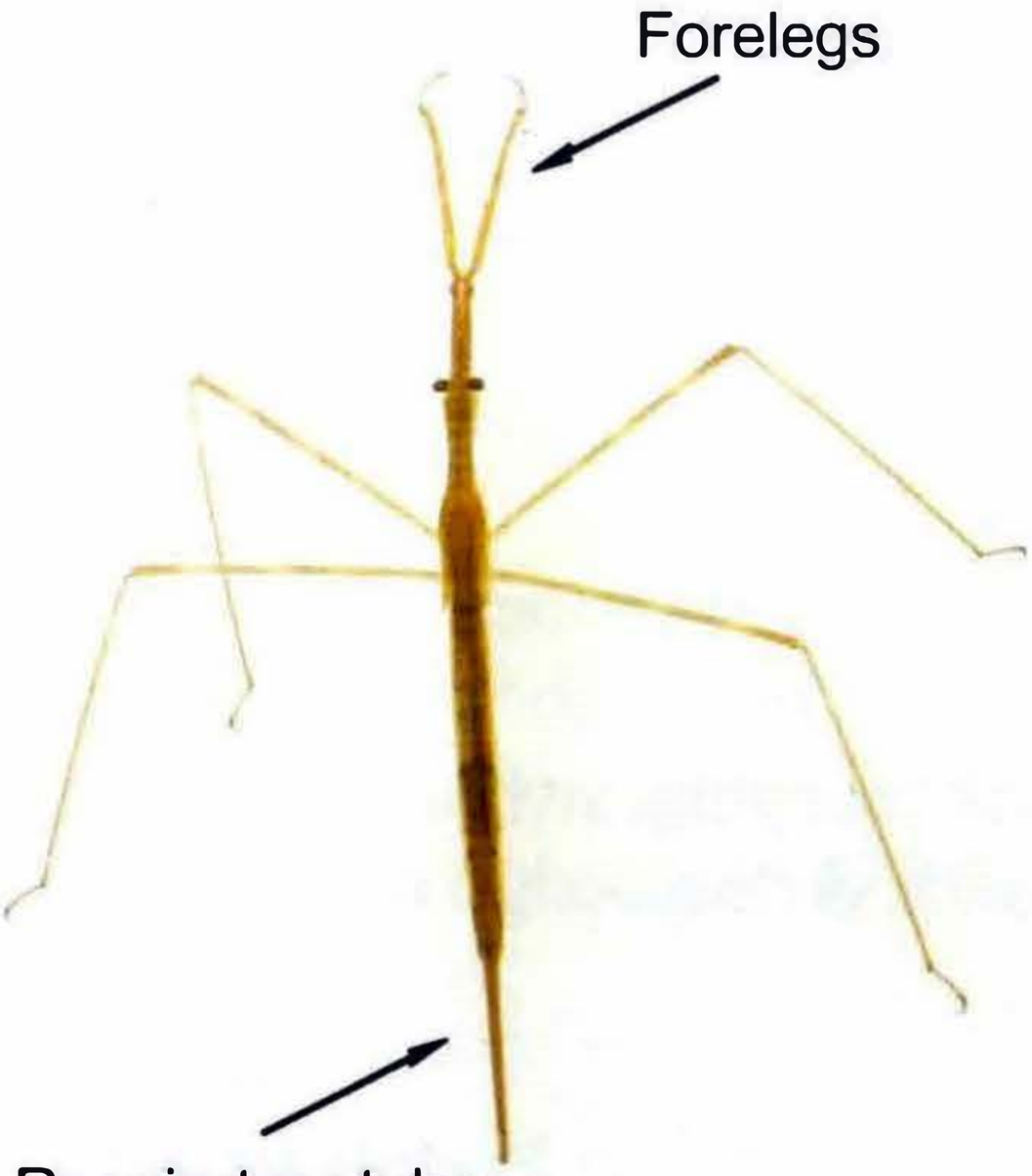
Colour

- Pale brown to dark brown or black

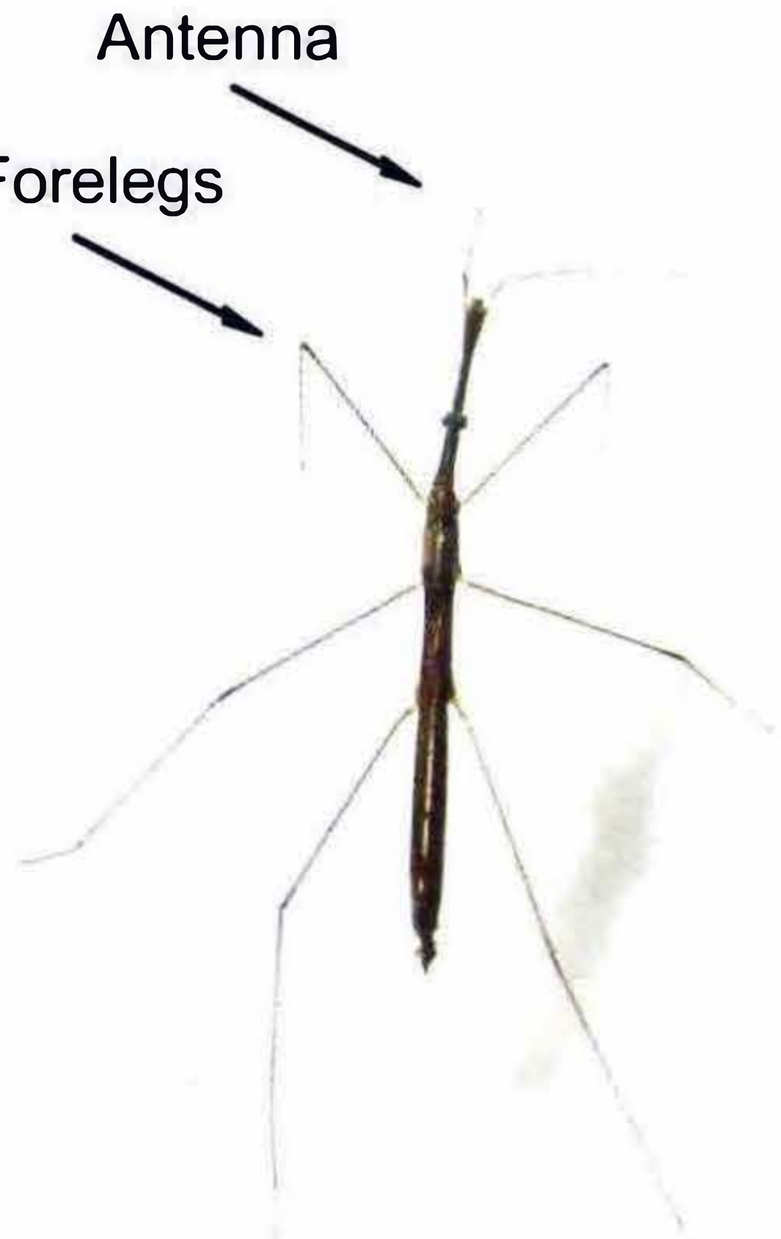
Sensitivity 1 5 10 15



Different types of Nepidae



Nepidae



Hydrometridae

Difference between Nepidae and Hydrometridae

Nepidae feasting on Libellulidae

Family name : Naucoridae

Common name : *Creeping water bugs*

Structure

- Oval, slightly flat bodies
- Heads exceptionally broad
- Forelegs adapted for holding prey
- A piercing beak situated under the head

Behaviour

- Move around in a fast half creeping, swimming fashion
- Stings viciously when handled carelessly

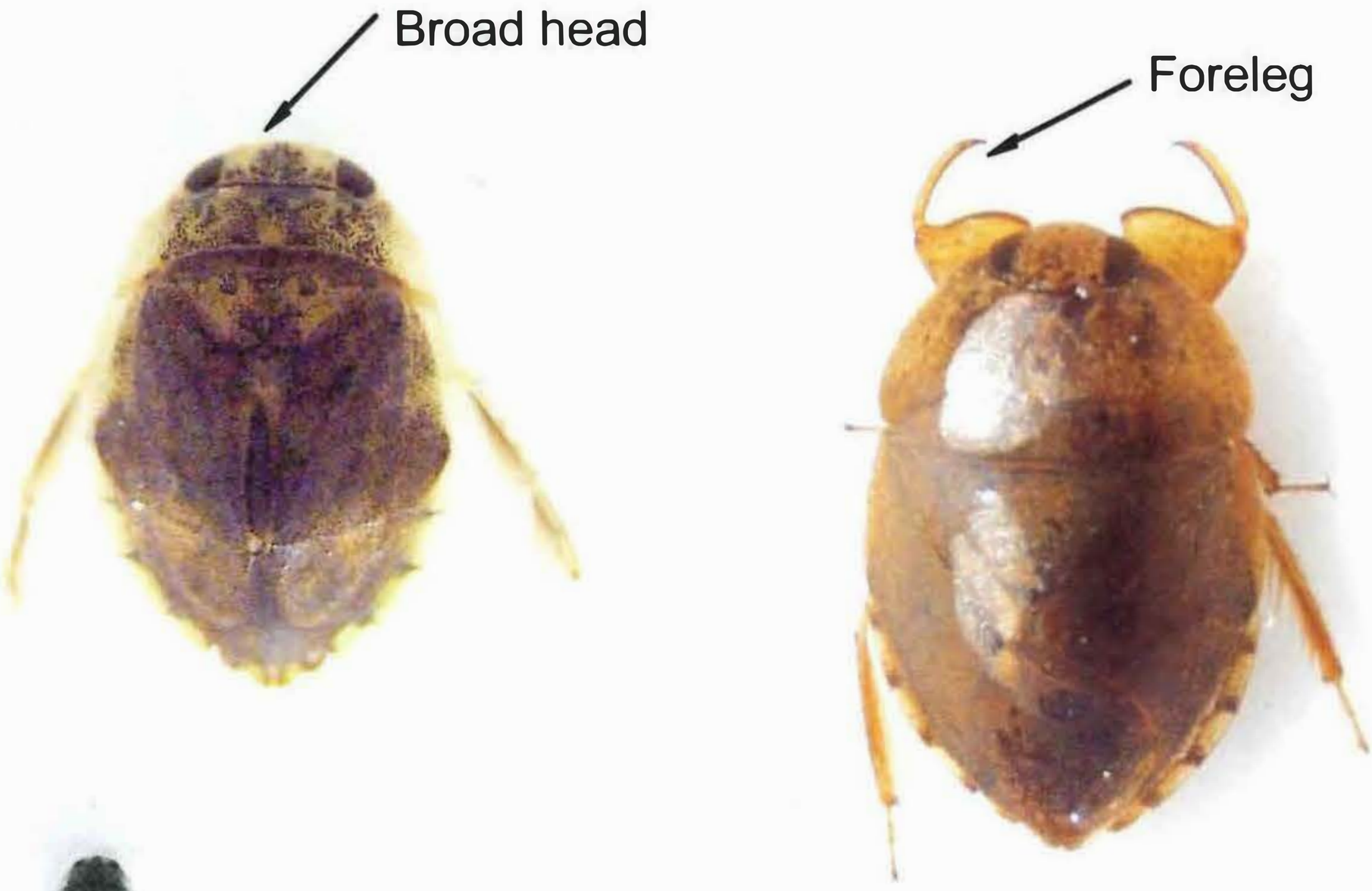
Habitat

- Dense vegetation
- Edges of streams

Colour

- Brown or green

Sensitivity



Different types of Naucoridae

Family name : Notonectidae

Common name : *Back swimmers*

Structure

- Unusually large eyes
- Long hind legs

Behaviour

- Swim on their backs using only the hind legs
- Rests with body at an angle with tip of abdomen in contact with the air
- Produce a burning sting when handled carelessly

Habitat

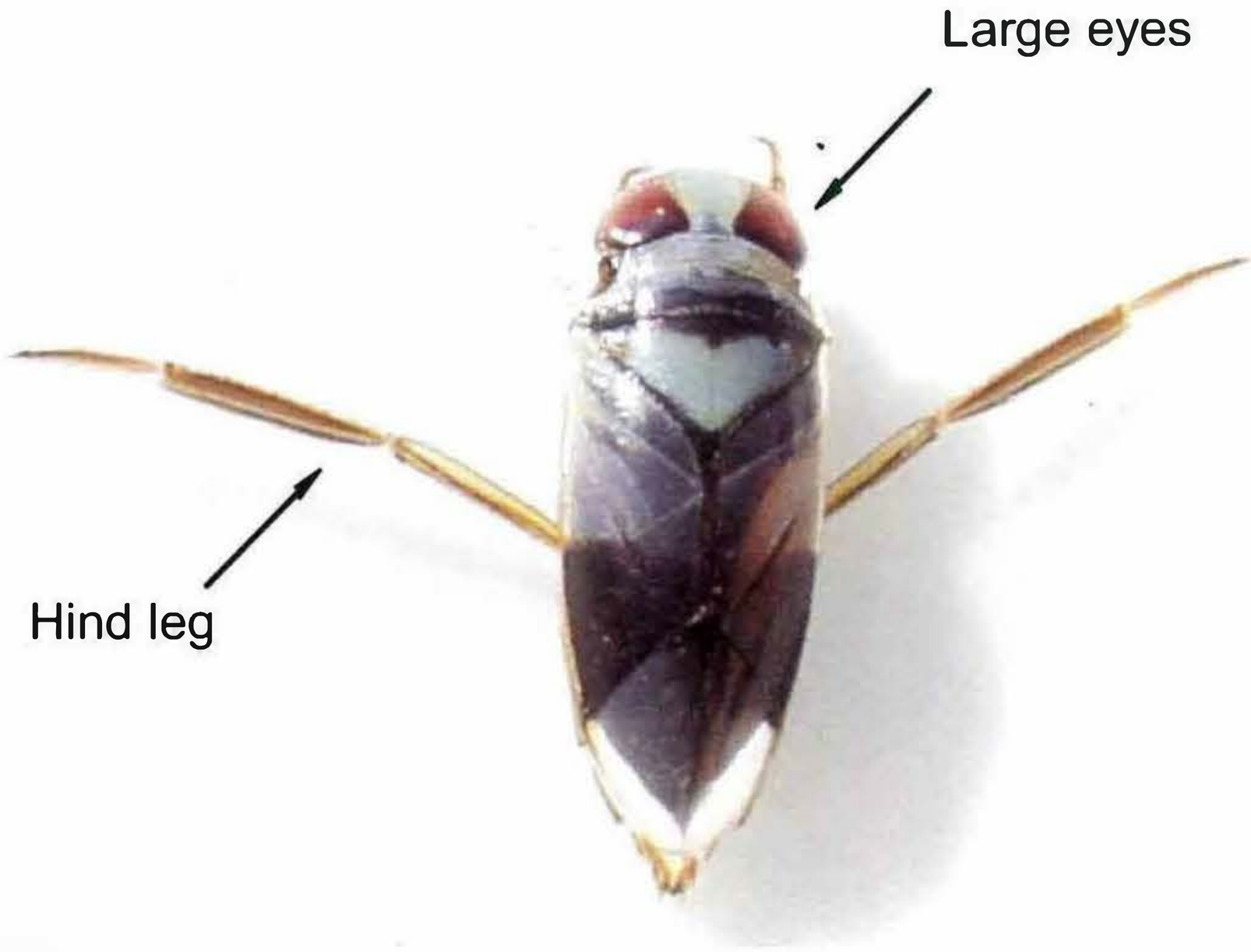
- Pools
- Backwaters of streams

Colour

- Patterns of white, pearl, yellow, brown and black

Sensitivity

1 5 10 15



Approximate Size

Notonectidae

Family name : Pleidae

Common name : *Pigmy backswimmers*

Structure

- Very small bodies
- Strongly arched backs

Behaviour

- Cling to submerged vegetation
- Swims with easy, fast motion
- Entire body covered with air bubble which shows as a silvery shine

Habitat

- Dense vegetation
- Shallow, clear water

Colour

- Yellow, grey or brown

Sensitivity 1 5 10 15

Pleidae

Side view

Approximate Size

Family name : Veliidae

Common name : *Broad-shouldered water striders*

Structure

- Small, plump bodies
- Legs adapted for running
- Middle and hind legs attaches to body at its widest part

Behaviour

- Running on surface of water
- Scatters in all directions when disturbed

Habitat

- Pools
- Some species prefer riffles in small streams

Colour

- Brown or black

Sensitivity

Approximate Size

Approximate Size

Different types of Veliidae

ORDER : ODONATA
Dragonflies / Damselflies

Odonata is divided into two suborders, namely:
Anisoptera, (true dragonflies) and
Zygoptera, (damselflies).
It is easy to distinguish between the two when in the adult stages as true dragonflies are large insects, holding the wings horizontal when at rest. Damselflies are small, slender insects, folding the wings parallel with the abdomen when at rest.

The nymphal stages of Odonata are probably the best- known as they are large and easy to spot.
Dragonfly nymphs are robust creatures, mostly brown or speckled, living under stones or in the sand. These nymphs move in a fascinating way. Water is taken into the body for respiration purposes and then squirted out through the anus, which means that they actually propel themselves with a stream of water.

Dragonfly nymph

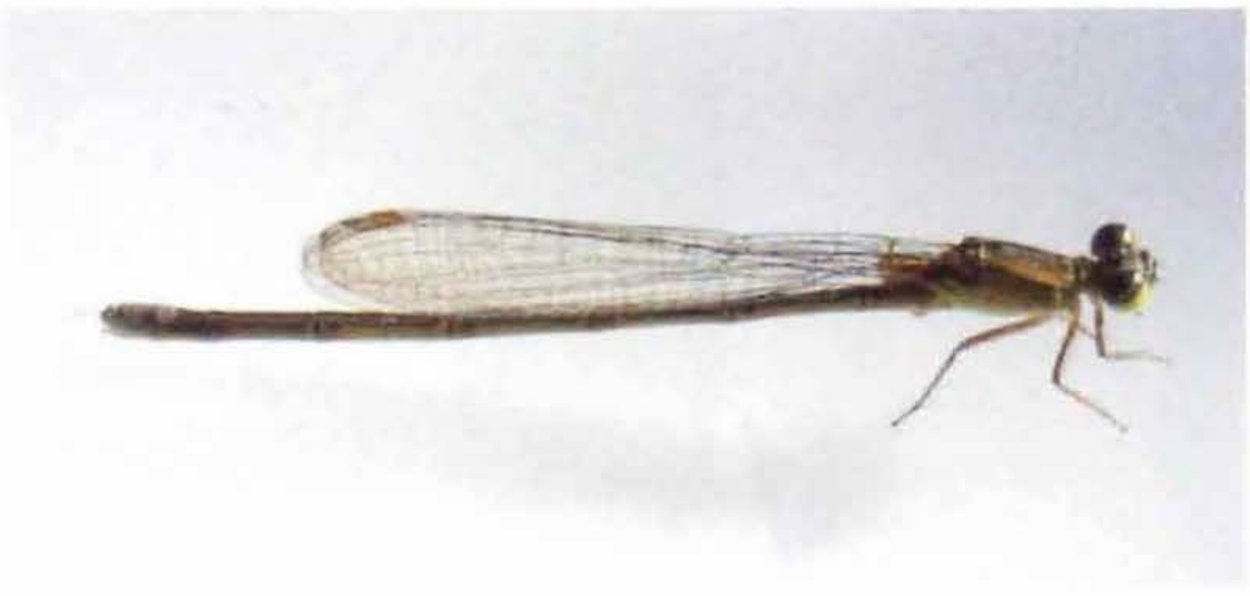
Dragonfly adult

The damselfly nymphs on the other hand, are more dainty, with long bodies and usually three gills at the tip of the abdomen. The shape and size of the gills differ greatly and can be used for identification purposes. These nymphs simply walk around amongst vegetation or swim in an awkward way, moving the abdomen from side to side.

Damselfly nymph

Both dragonfly nymphs and damselfly nymphs have a modified lower lip, the mask, which lies folded back under the head. This mask can fold open to catch prey. The end of the mask widens, with different teeth arrangements and incisions - also used for identification purposes.(See page 95)

Just before transformation, the nymphs would crawl out of the water, usually onto vegetation or other suitable objects. The outer skin splits open on the back, and when this opening is large enough, the new adult emerges. It sits on the old skeleton for an hour or more until the wings are dry and hard.



Damselfly adult

Family name : Aeshnidae

Common name : *Dragonflies*

Structure

- Long, tapering bodies
- Large eyes
- Thin antennae

Behaviour

- Walking
- Swims in short bursts as water is propelled out of the body

Habitat

- Under stones
- Slow or fast streams

Colour

- Green, brown or black

Sensitivity

Different types of Aeshnidae

Family name : Gomphidae

Common name : *Dragonflies*

Structure

- Body shapes differ, depending on species
- Large dark eyes
- Short stubby antennae
- Legs adapted for digging in sand

Behaviour

- Crawl about under sand, leaving tracks or indentations in the sand
- Swim in short bursts using jet propulsion

Habitat

- Sand banks, muddy patches
- Edges of streams

Colour

- Pale, medium brown

Sensitivity

Approximate Size

Approximate Size

Different types of Gomphidae

Family name : Corduliidae

Common name : *Dragonflies*

Structure

- Oval bodies
- Rounded heads
- Very long legs

Behaviour

- Walking
- Swims with legs stretched out backwards

Habitat

- Stones
- Slower areas of the stream

Colour

- Pale brown, speckled

Sensitivity

Approximate Size

Corduliidae nymph

Family name : Libellulidae

Common name : *Dragonflies*

Structure

- Oval bodies
- Triangular heads
- Bulging *eyes*
- Legs not as long as with Corduliidae

Behaviour

- Walking
- Swims in short bursts, legs are held in one position

Habitat

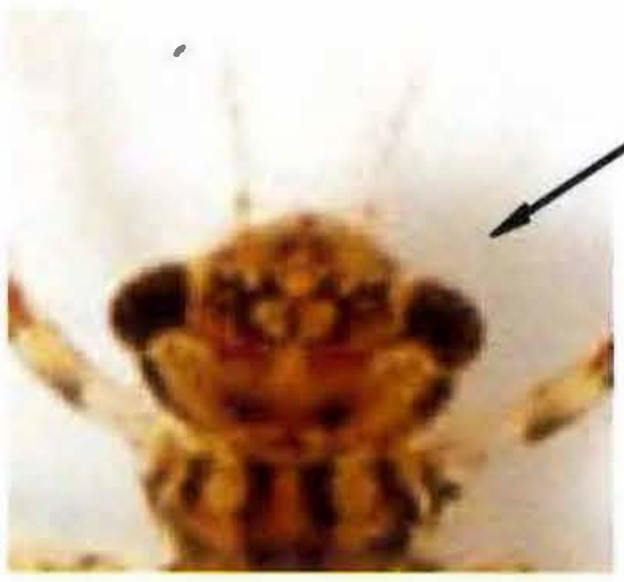
- Stones, muddy patches
- Backwater areas, very slow streams

Colour

- Pale, speckled or dark brown

Sensitivity

1 5 10 15



Different types of Libellulidae

Family name : Calopterygidae

Common name : *Damselflies*

Structure

- Long, cylindrical body
- Long antennae, with base wider than tip
- Three large gills, swollen, hollow on inside

Behaviour

- Slow moving amongst vegetation

Habitat

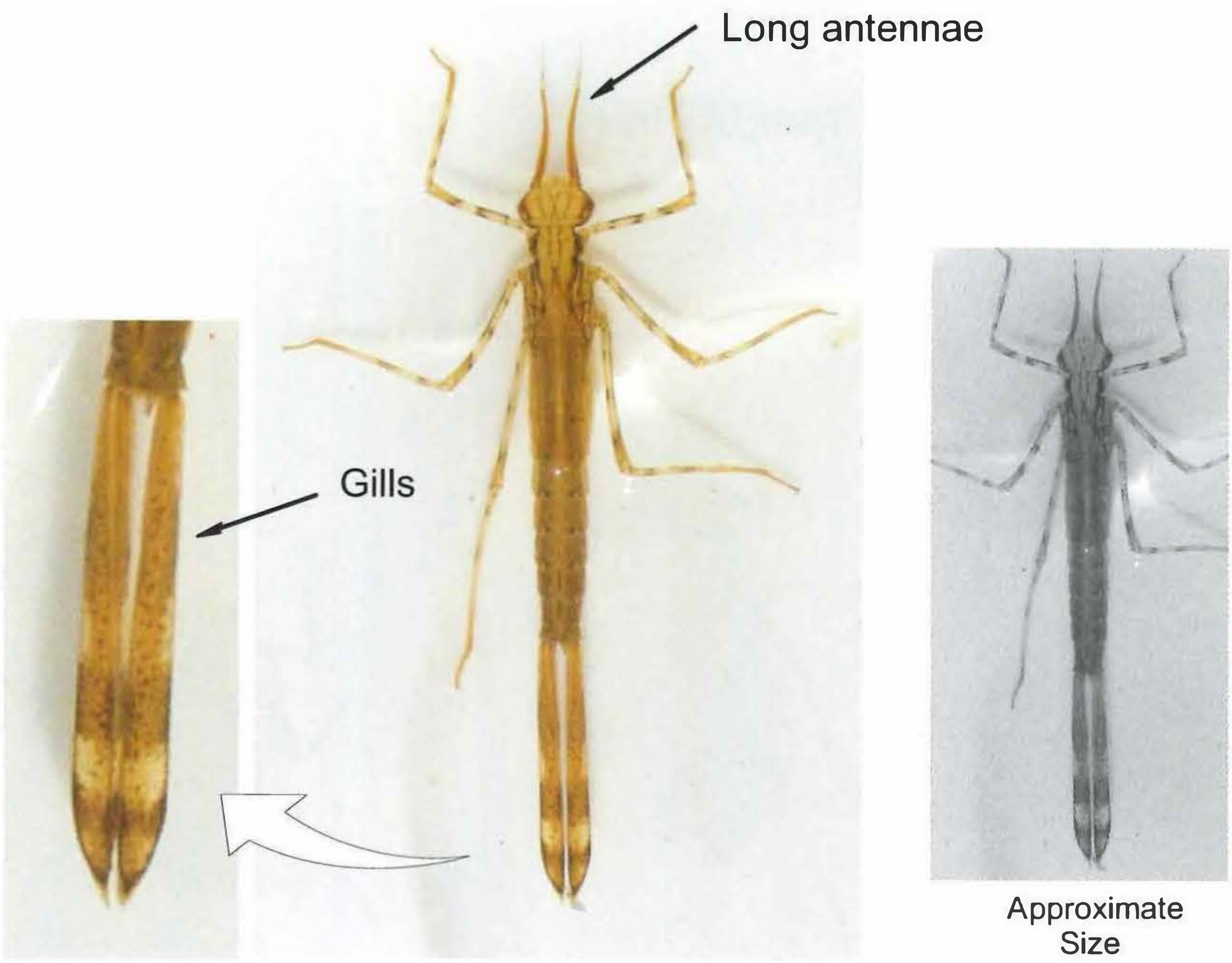
- Vegetation
- Edges of streams

Colour

- Pale brown

Sensitivity

1 5 10 15



Calopterygidae nymph

Family name : Chlorocyphidae

Common name : *Damselflies*

Structure

- Short, cylindrical bodies
- Two stiff gills
- Gills serrated

Behaviour

- Walks slowly with abdomen and gills tilted upwards

Habitat

- Under stones
- Backwater areas or slow streams

Colour

- Brown or dark brown

Sensitivity

Chlorocyphidae nymph

Family name : Chlorolestidae (Synlestidae)

Common name : *Damselflies*

Structure

- Long slim bodies
- Long antennae
- Three gills with rounded tips, single dark band across each gill

Behaviour

- Slow moving amongst vegetation

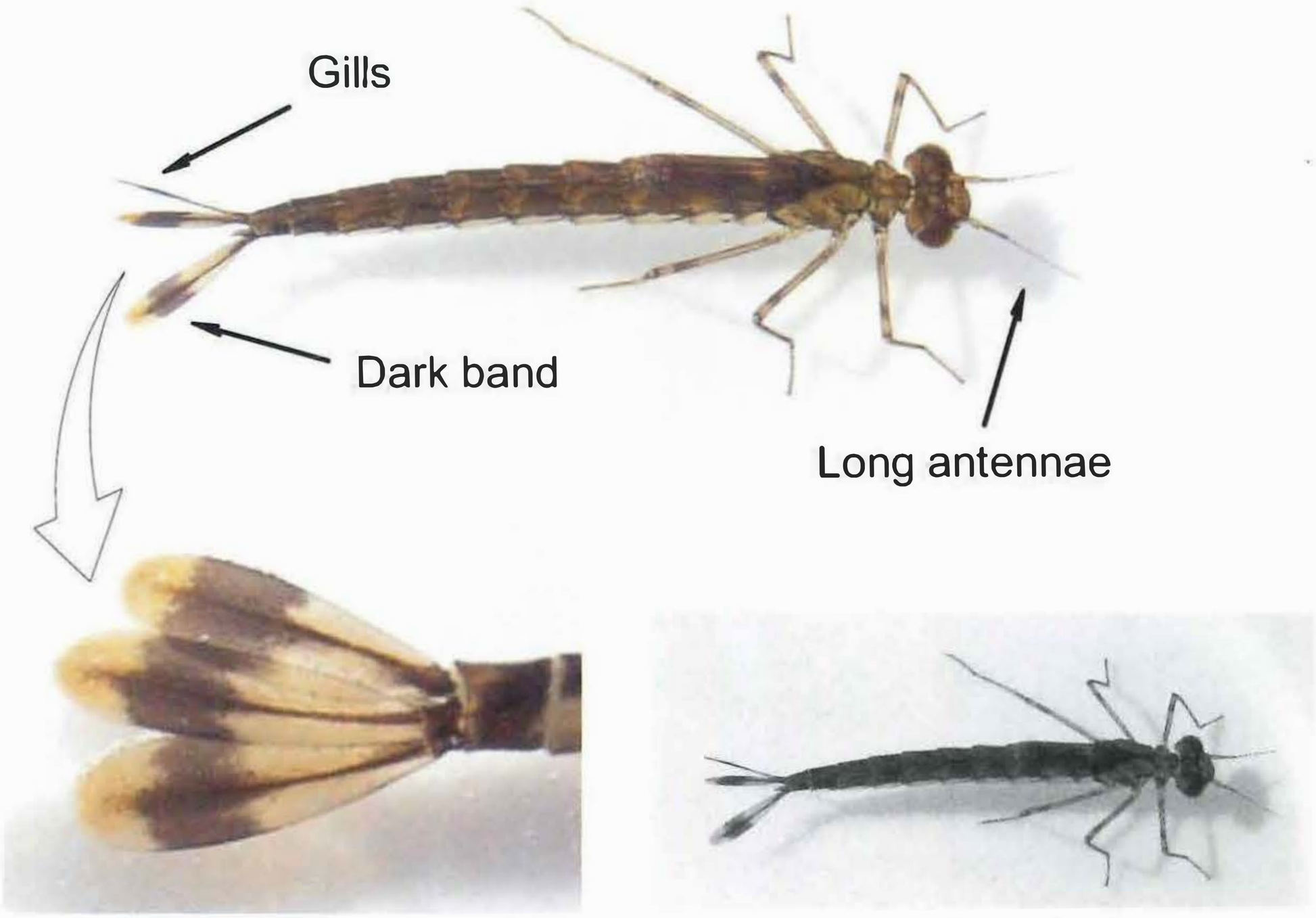
Habitat

- Vegetation
- Edges of slow streams

Colour

- Pale brown

Sensitivity



Approximate Size

Chlorolestidae nymph

Family name : Coenagrionidae

Common name : *Damselflies*

Structure

- Slender bodies
- Three leaf-like gills, pointed tips
- Certain species with jointed gills

Behaviour

- Slow moving amongst vegetation

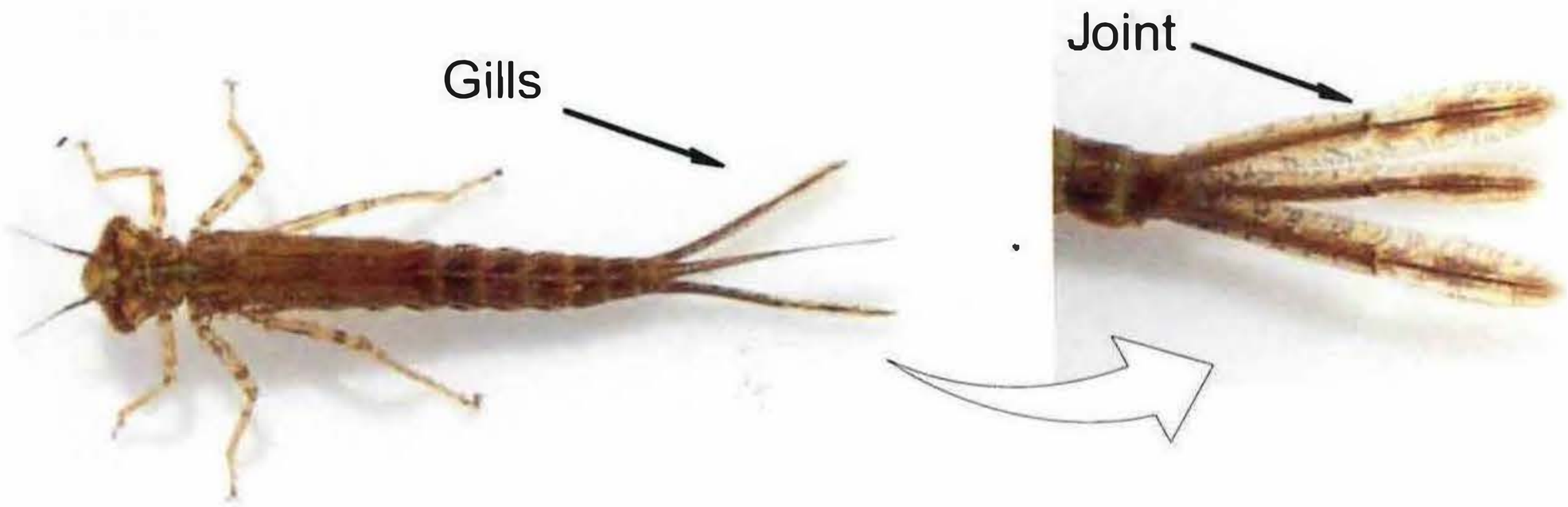
Habitat

- Vegetation
- Edges of streams

Colour

- Pale, green or brown

Sensitivity



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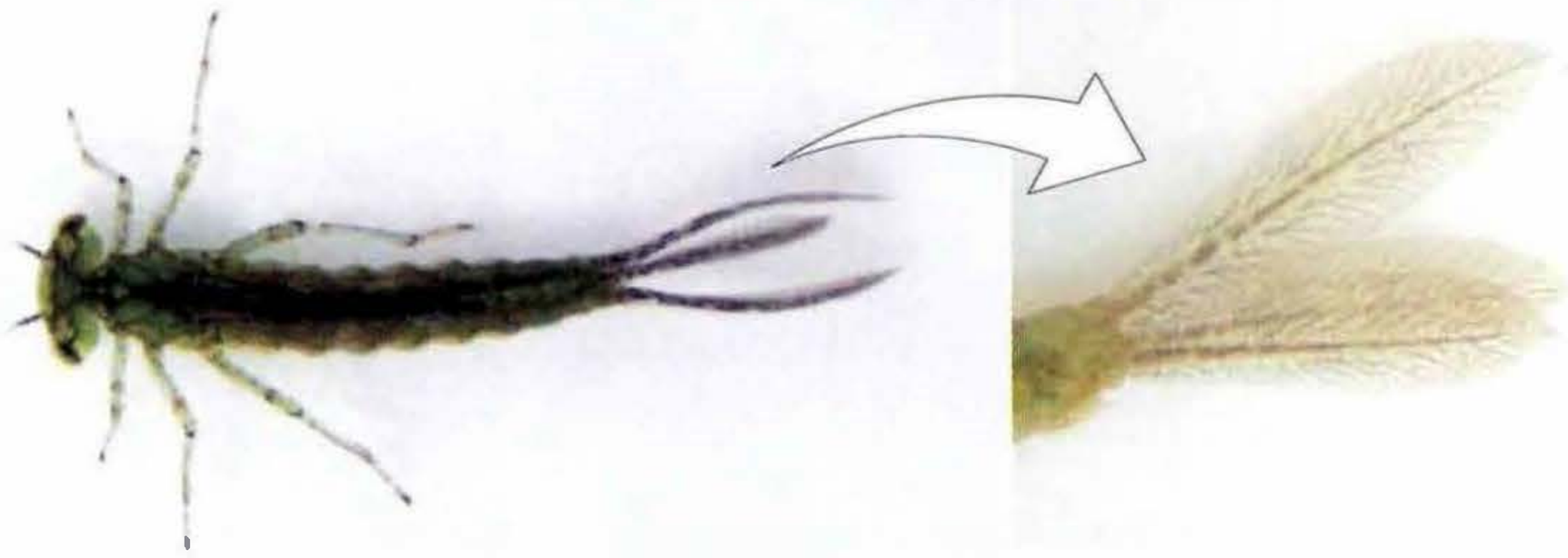


Different types of Coenagrionidae

Family name : Lestidae

Common name : *Damselflies*

Structure

- Very long, very slim bodies
- Large wide heads
- Long, very thin legs
- Three long gills, rounded tips, curved

Behaviour

- Slow moving amongst vegetation

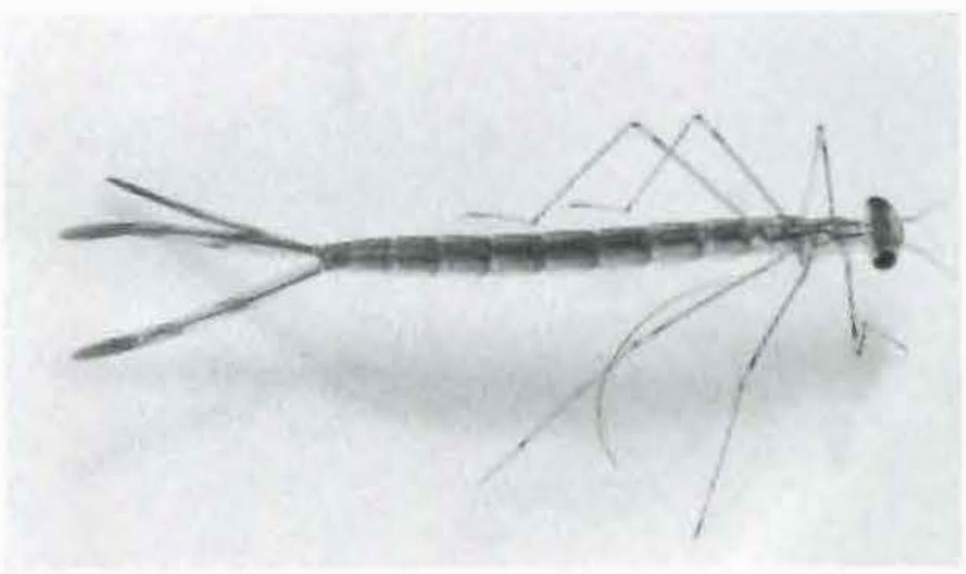
Habitat

- Vegetation
- Backwater areas, pools

Colour

- Brown

Sensitivity



Approximate
Size

Lestidae nymph

Family name : Platycnemidae

Common name : *Damselflies*

Structure

- Short, stout bodies
- Strong legs
- Three short gills with dark band across
- Gills swollen, hollow on the inside

Behaviour

- Cimbers on rocks or vegetation

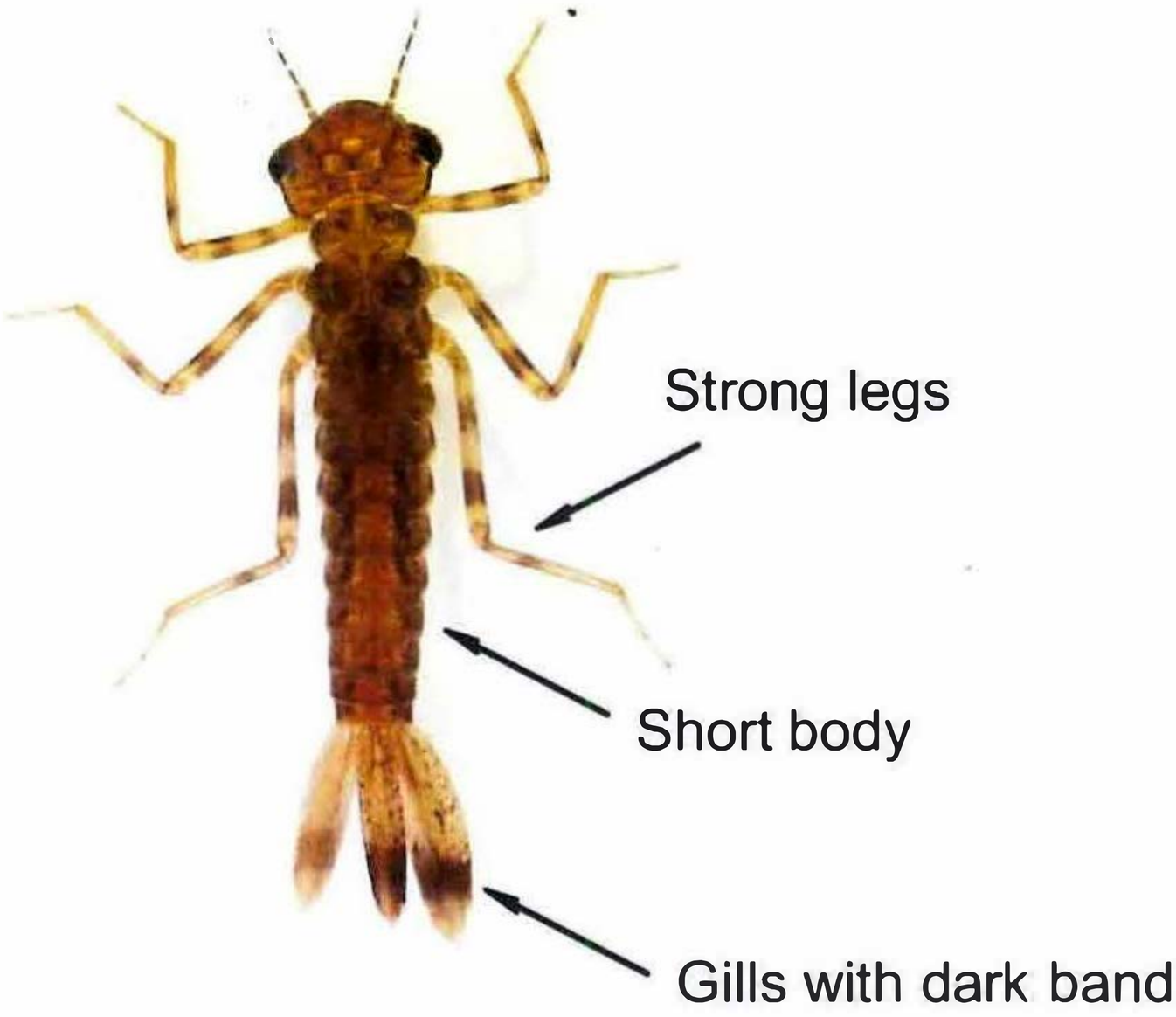
Habitat

- Under stones, on vegetation
- Headwaters of streams

Colour

- Brown

Sensitivity



Approximate Size

Platycnemidae nymph

Family name : Protoneuridae

Common name : *Damselflies*

Structure

- Short tapering bodies
- Long legs, hind legs reaching tips of gills
- Pedicels present at base of gills

Behaviour

- Slow moving amongst vegetation

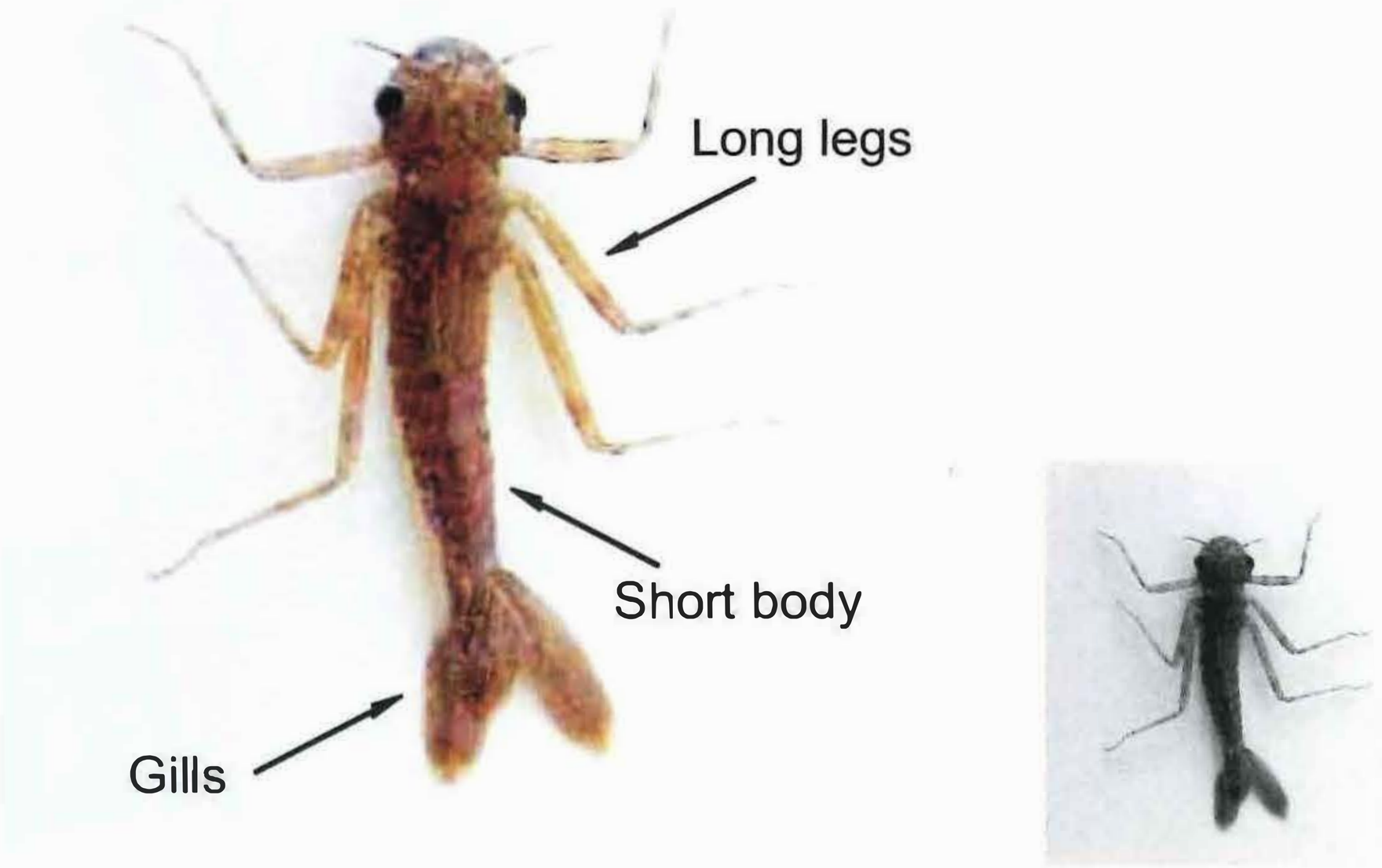
Habitat

- Vegetation
- Headwaters of streams

Colour

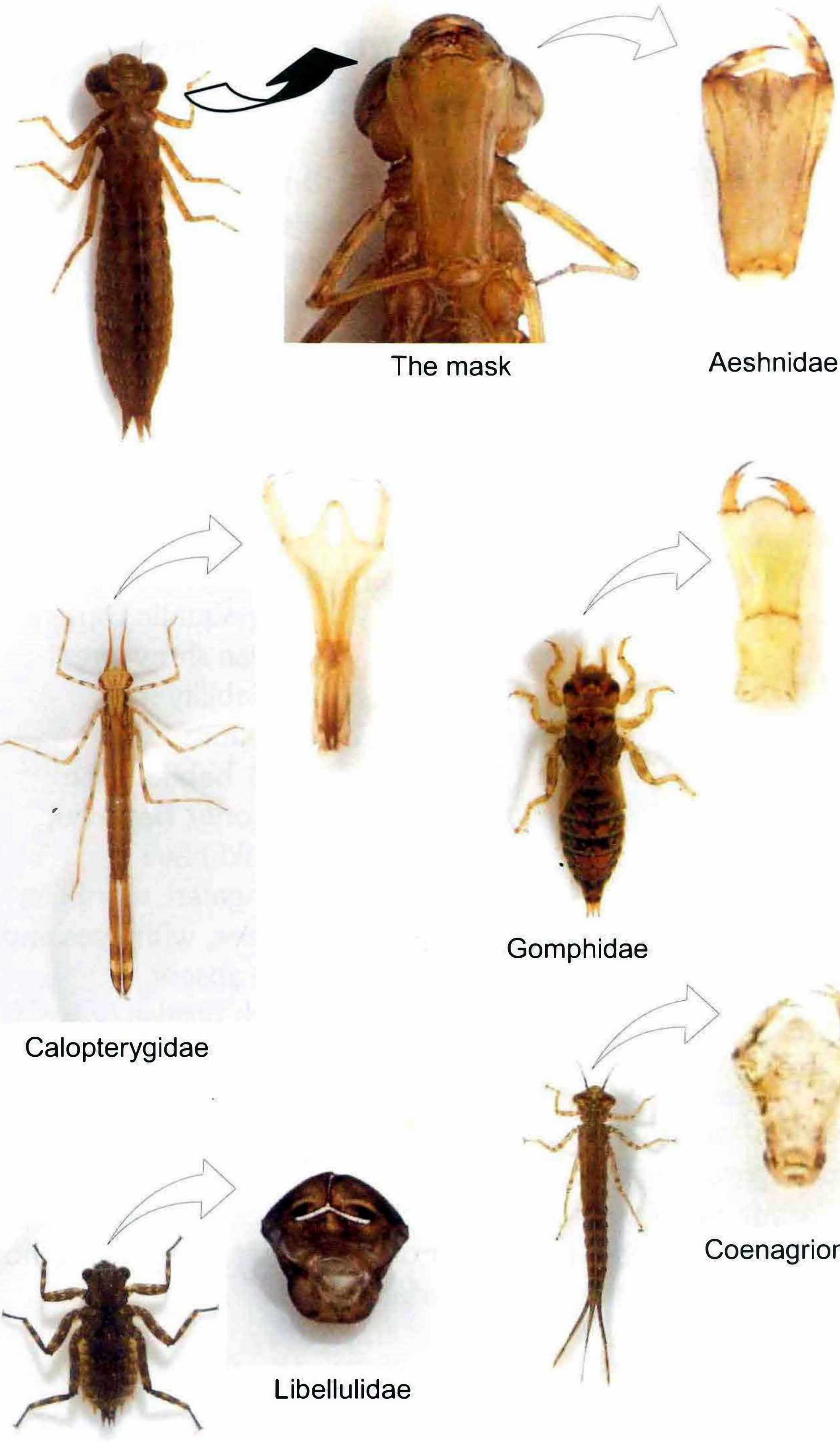
- Brown

Sensitivity



Approximate Size

Protoneuridae nymph



The mask

Aeshnidae

Calopterygidae

Gomphidae

Coenagrionidae

Libellulidae

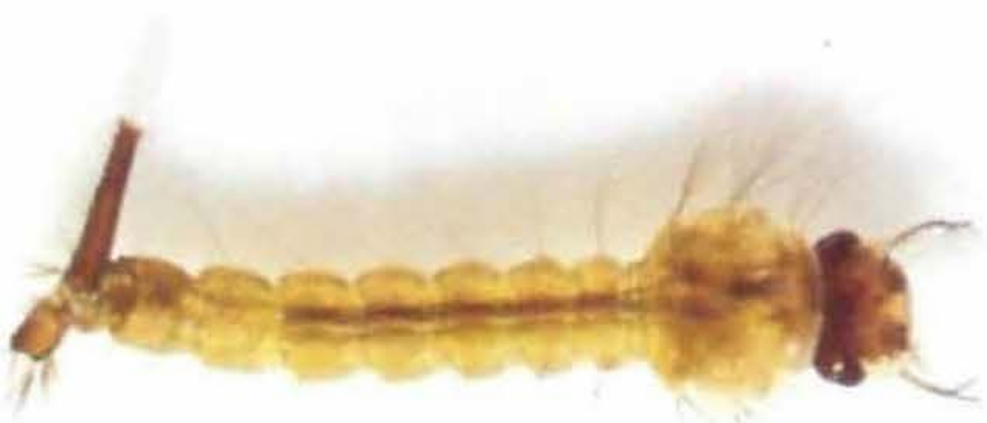
Different mask shapes

ORDER : DIPTERA

Flies, mosquitoes, midges

Diptera is one of the largest orders of insects with only a few families having aquatic larval or pupal stages.
Man likes to think of Diptera in a negative way, mainly because the common types such as houseflies and mosquitoes can be such a nuisance, and also carry disease such as Malaria that is spread by the female Anopheles mosquito.

Dipteran larvae occur in almost every conceivable aquatic habitat, from tree holes (e.g. Chironomidae and Culicidae) to streams, ponds, stagnant pools and even rushing rivers (e.g. Blepharoceridae)



Diptera larva

The aquatic Diptera larvae show great variability in structure and habitat. The majority, however, would have elongated, wormlike bodies, with eyes and legs absent.
The bodies are soft, naked, or covered with bristles or scales.

Some larvae are able to swim with rapid wriggling motion, others would simply crawl around using suckers, spines or prolegs to drag themselves forward.
Certain families, such as Culicidae and Syrphidae, are not equipped to obtain oxygen from the water. They use siphons that are pushed through the surface film.

At the end of the larval stage the skin hardens to form a pupal case. Most Diptera pupa are inactive, floating aroundo r tightly fastened to rocks or other solid substrate. Mosquito and midge pupae are the only ones able to move around by twitching the body.

Diptera pupa

Pupal stages generally last less than two weeks, after which the case splits open and the young adult emerges.

Family name : Athericidae

Common name : *Snipe flies*

Structure

- Elongated, cylindrical
- Head retractable
- End of abdomen forks into two fringed appendages
- Paired prolegs on abdomen

Behaviour

- Excessive twitching of the body when disturbed

Habitat

- Leaf pockets
- Mountain streams

Colour

- Brown

Sensitivity

Approximate Size

Athericidae larva

Family name : Blepharoceridae

Common name : *Net-winged midges*

Structure

- Bodies flattened
- Segments deeply incised
- First six segments with suckers underneath
- Prolegs and tufts of gills on the sides

Behaviour

- Closely attached to substrate
- Slow movement using suckers and prolegs

Habitat

- Stones
- Mountain streams

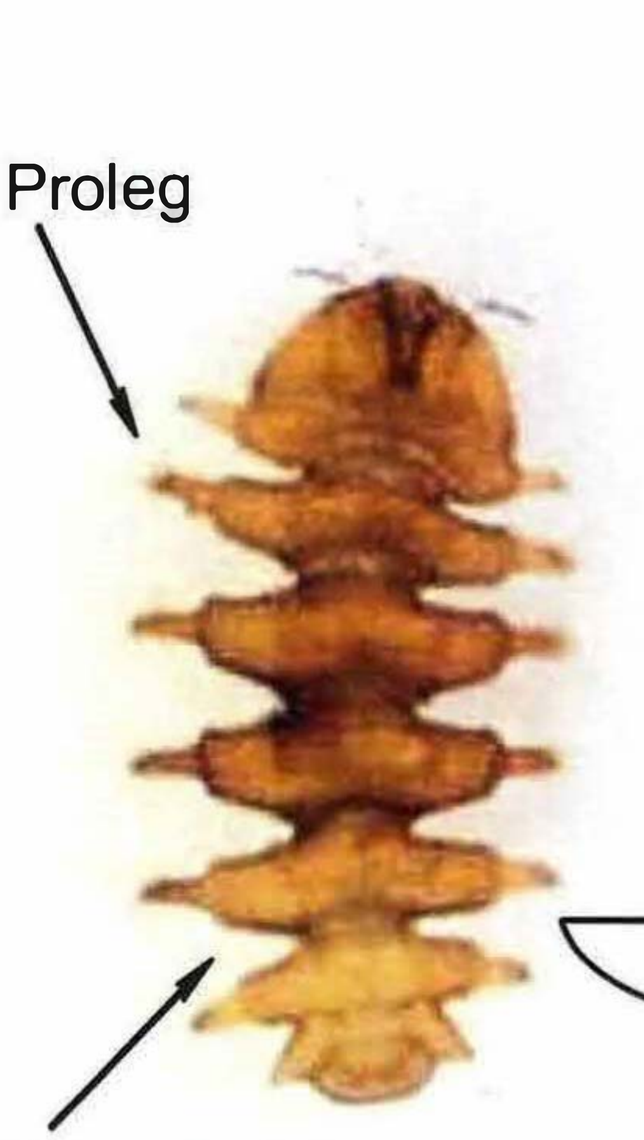
Colour

- Light brown to dark brown

Sensitivity

1 5 10 15

Blepharocerid Pupa



Approximate Size

Approximate Size

Blepharoceridae larva and pupa

Family name : Ceratopogonidae

Common name : *Biting midges*

Structure

- Very thin, hair-like
- All body segments equal in diameter
- No prolegs
- No respiratory tube on abdomen

Behaviour

- Swim with curved body, like a snake

Habitat

- Sand, mud
- Edges of streams

Colour

- Pale or brown

Sensitivity

Ceratopogonidae larva

Approximate Size

Family name : Chironomidae

Common name : *Midges*

Structure

- Slender, elongated, cylindrical
- Small heads
- Prolegs and gill appendages on tip of abdomen

Behaviour

- Back and forth flicking of entire body

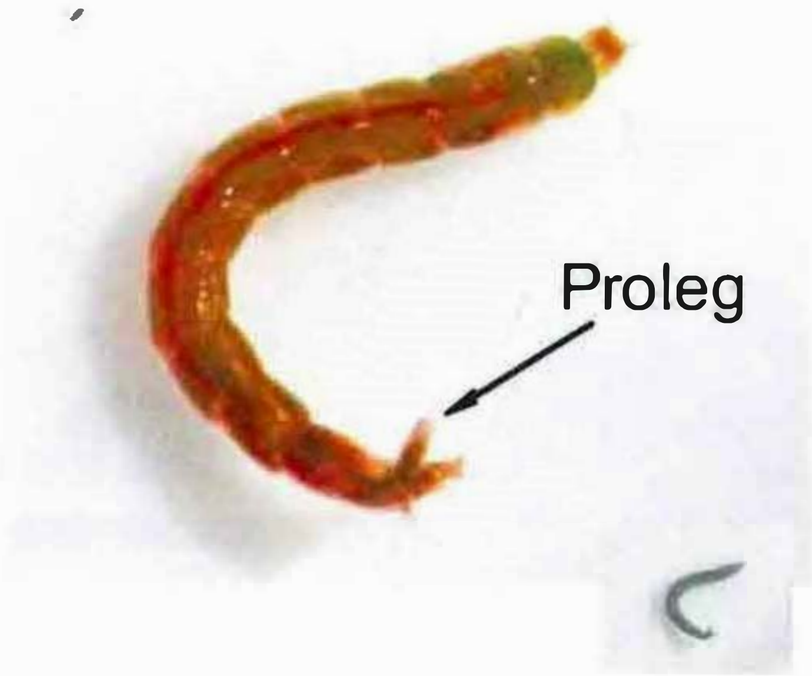
Habitat

- Silk tubes on any type of substrate
- Pools, streams
- Any container filled with water

Colour

- Yellow, brown, green, red

Sensitivity 1 5 10 15



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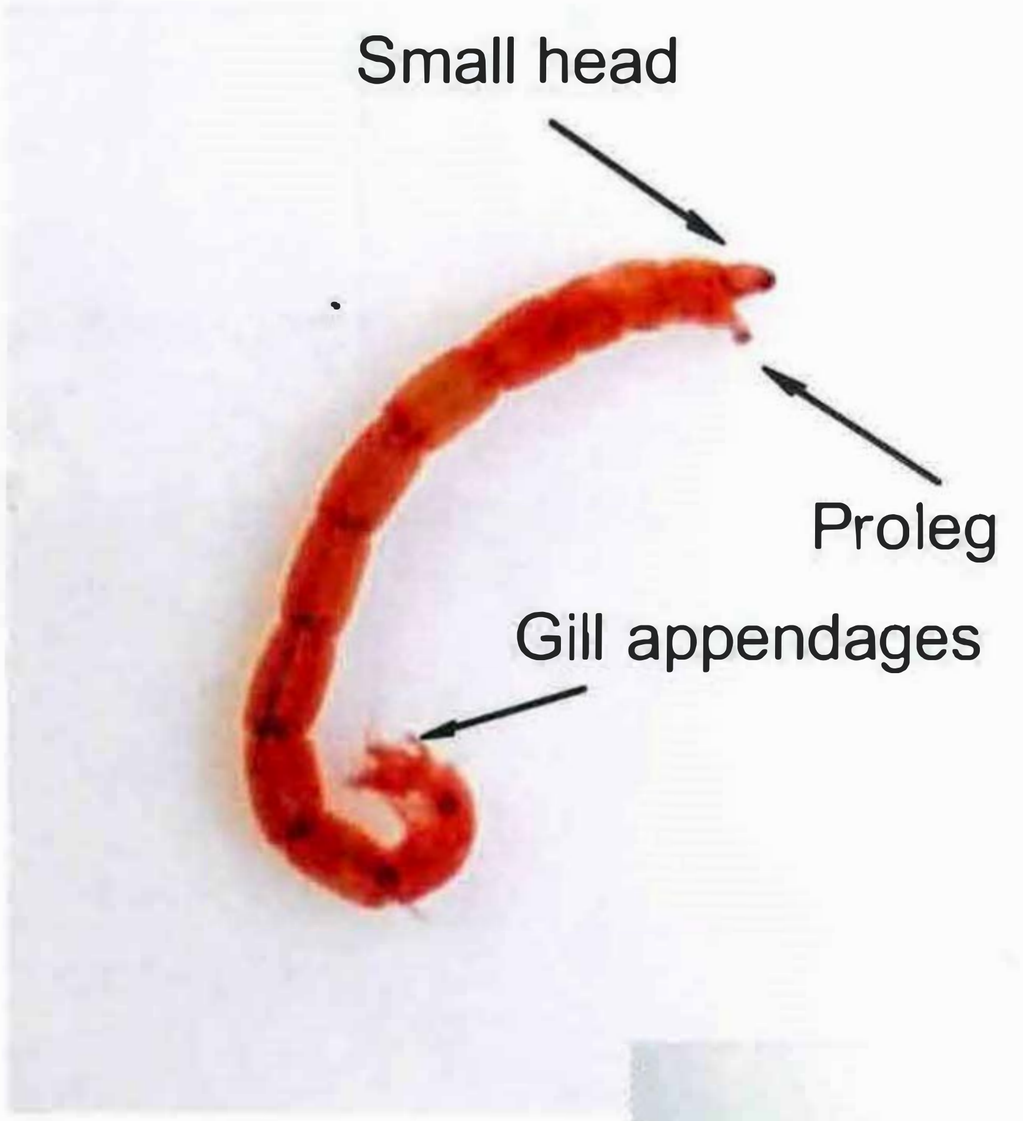


Approximate Size

Approximate Size

Chironomidae larva

Family name : Culicidae - larvae

Common name : *Mosquitoes*

Structure

- Elongated, covered with tufts of hair
- Large heads
- Segment behind head noticeably enlarged
- Respiratory tube on tip of abdomen

Behaviour

- Floats under surface, slanted, with respiratory tub e in contact with air
- Wriggles away when disturbed

Habitat

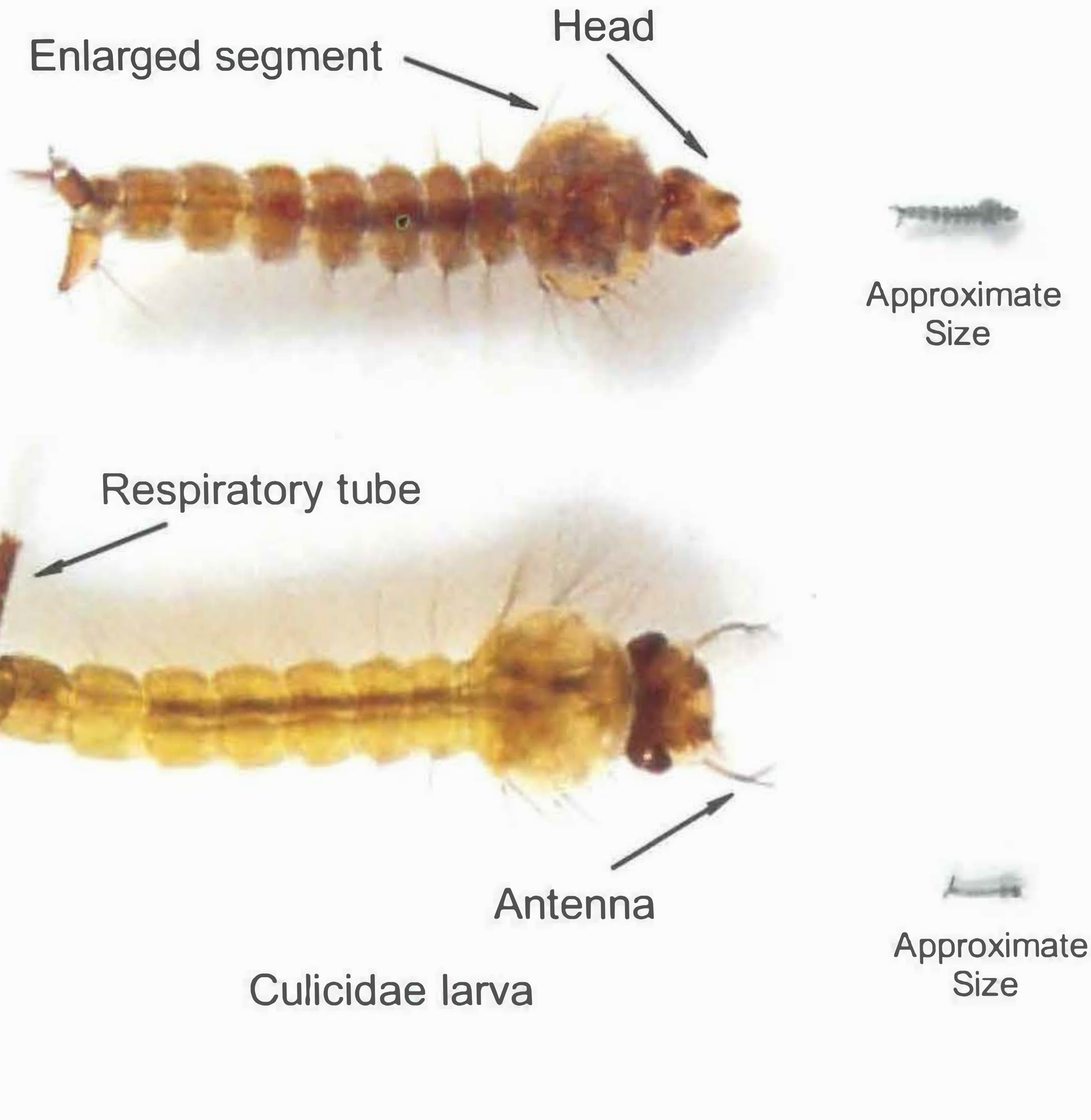
- Pools
- Any temporary puddle

Colour

- Yellow, brownish

Sensitivity

1 5 10 15



Culicidae larva

Family name : Culicidae - pupae

Common name : *Mosquitoes*

Structure

- Large heads
- Abdomen curved around head
- Two paddle-like structures on tip of abdomen
- Two ear-like structures on head

Behaviour

- Floats under the surface, curled up into a comma shape

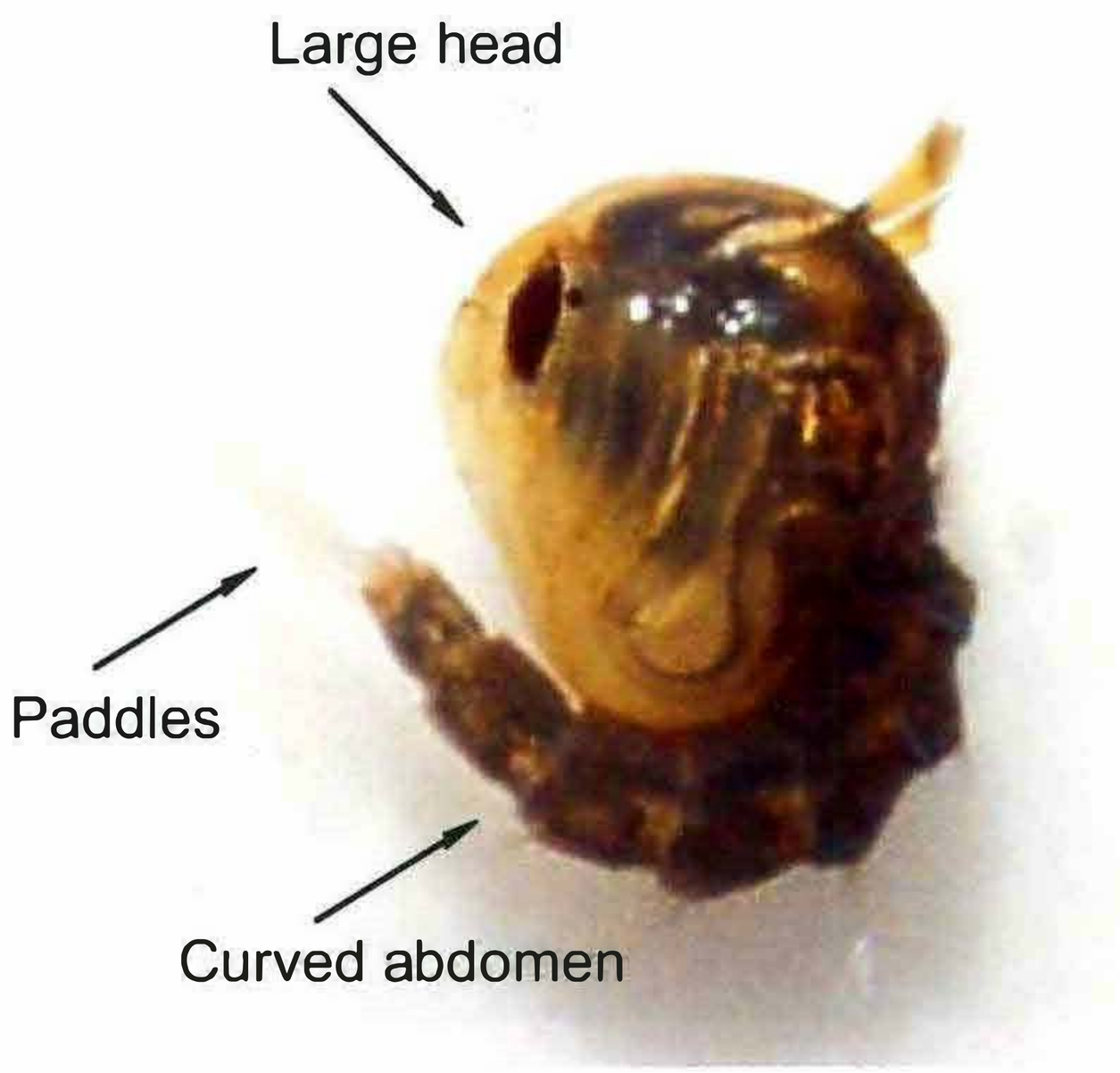
Habitat

- Pools
- Any temporary puddle

Colour

- Brown

Sensitivity



Approximate Size

Culicidae pupa

Family name : Dixidae

Common name : *Meniscus midges*

Structure

- Long, slender bodies
- Clearly defined heads
- Prolegs on only two segments
- A bundle of hairs and lobes on tip of abdomen

Behaviour

- Floats on, or just under the surface
- Body bent in a U shape
- Swims in a zig-zag fashion

Habitat

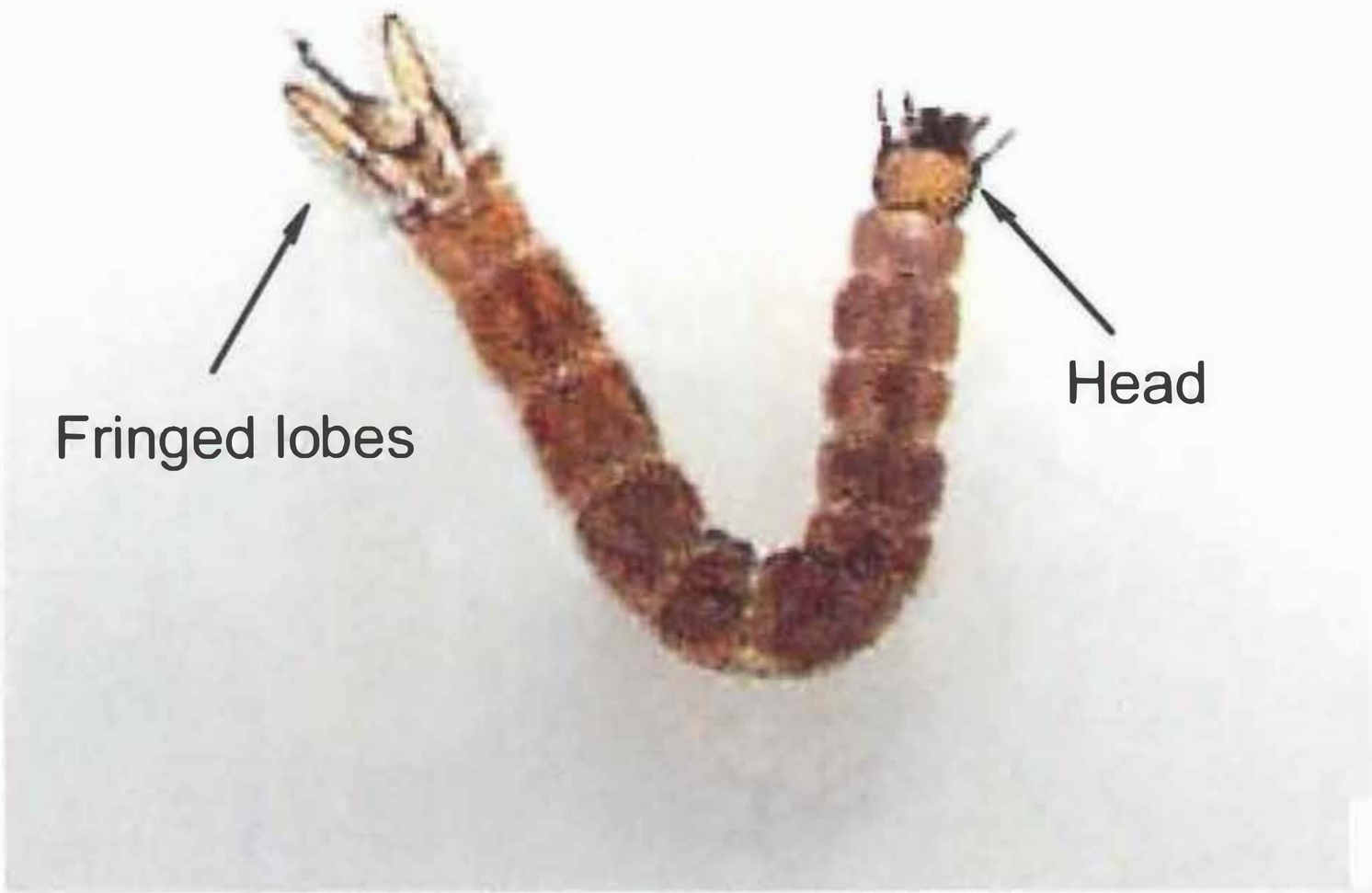
- Slow streams
- Backwater areas of fast streams

Colour

- Brown or black

Sensitivity

1 5 10 15



Dixidae larva

Approximate Size

Family name : Ephydridae

Common name : *Shore flies*

Structure

- Soft, cylindrical bodies
- Mouth hooks
- Prolegs present
- Forked respiratory tube on tip of abdomen

Behaviour

- Slow crawling motion
- Inactive with respiratory tube in contact with air

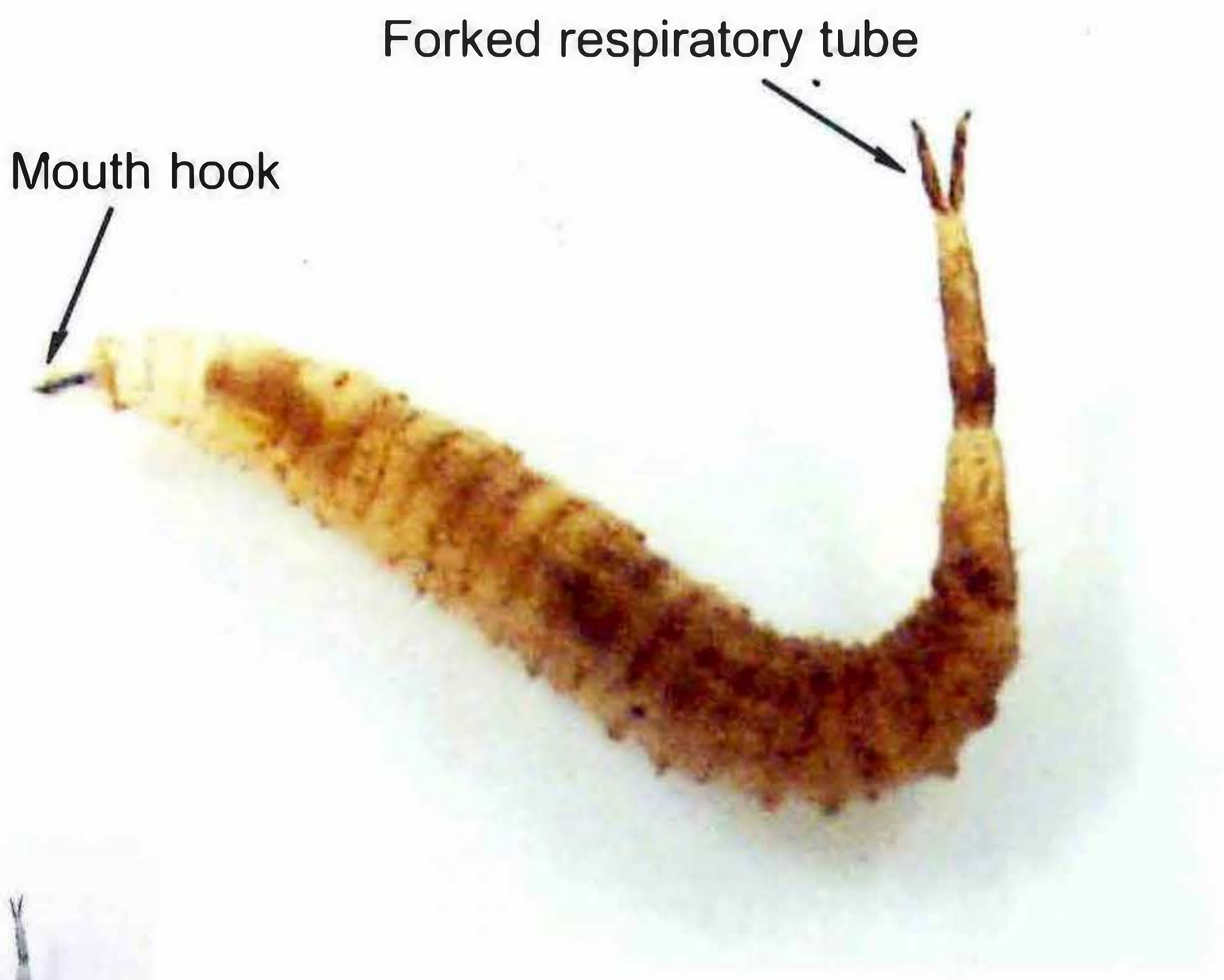
Habitat

- Shallow pools, puddles, stagnant saline water

Colour

- Pale, yellowish brown

Sensitivity



Approximate Size

Ephydridae larva

Family name : Muscidae

Common name : *House flies*

Structure

- Soft, smooth tapered
- Retractable heads
- Black mouth hooks
- Pupae housed in closed capsules

Behaviour

- Creeping whilst probing with head
- Pupae float on surface

Habitat

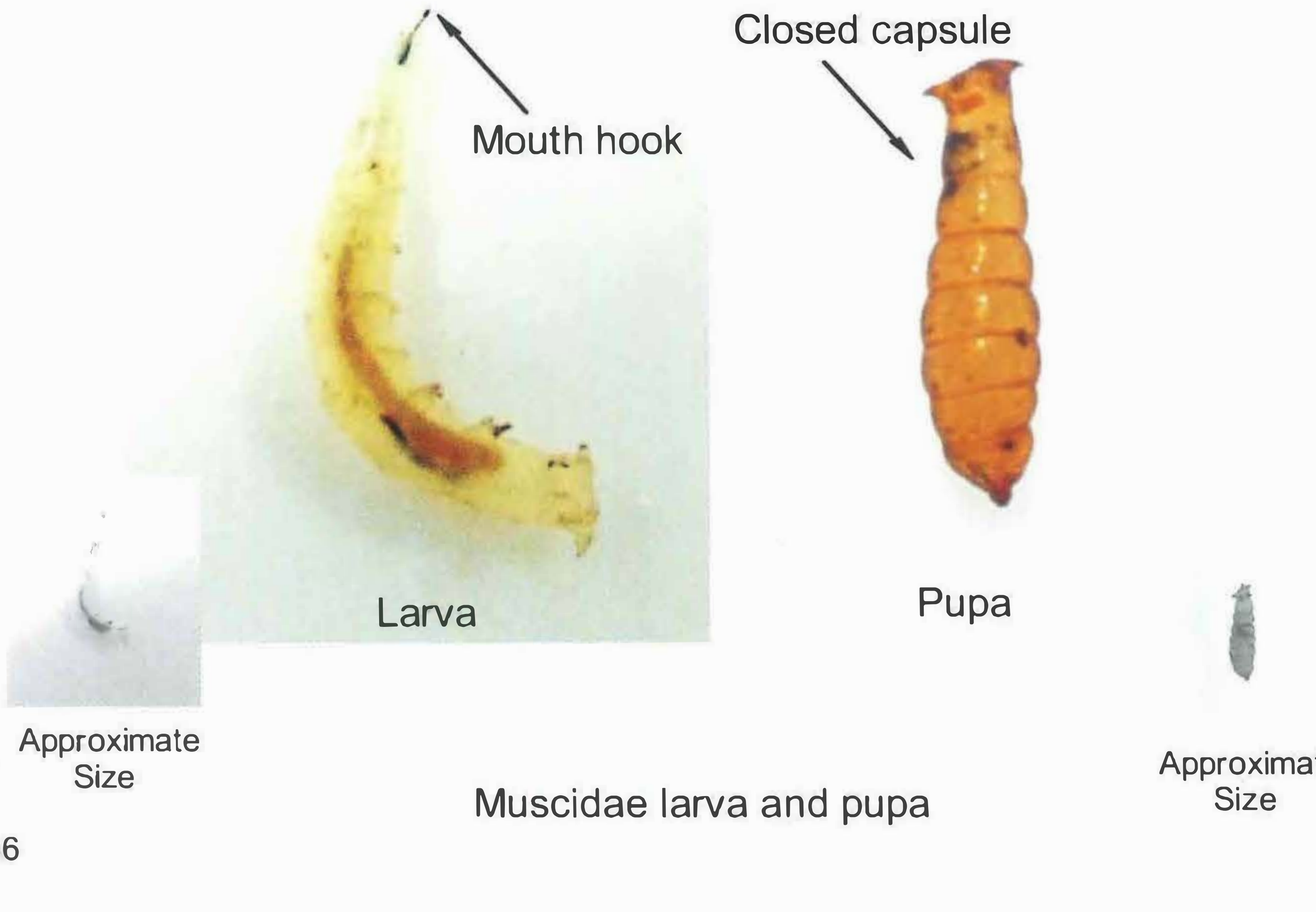
- Moss or masses of algae
- Shallow, still water

Colour

- White
- Pupae brown

Sensitivity

1 5 10 15



Muscidae larva and pupa

Family name : Psychodidae

Common name : *Moth flies*

Structure

- Slender, cylindrical, covered with fine hair
- Small, hardened head
- Dark hardened plates on all segments
- Single tube and tuft of hair on tip of abdomen

Behaviour

- Active creeping, crawling motion

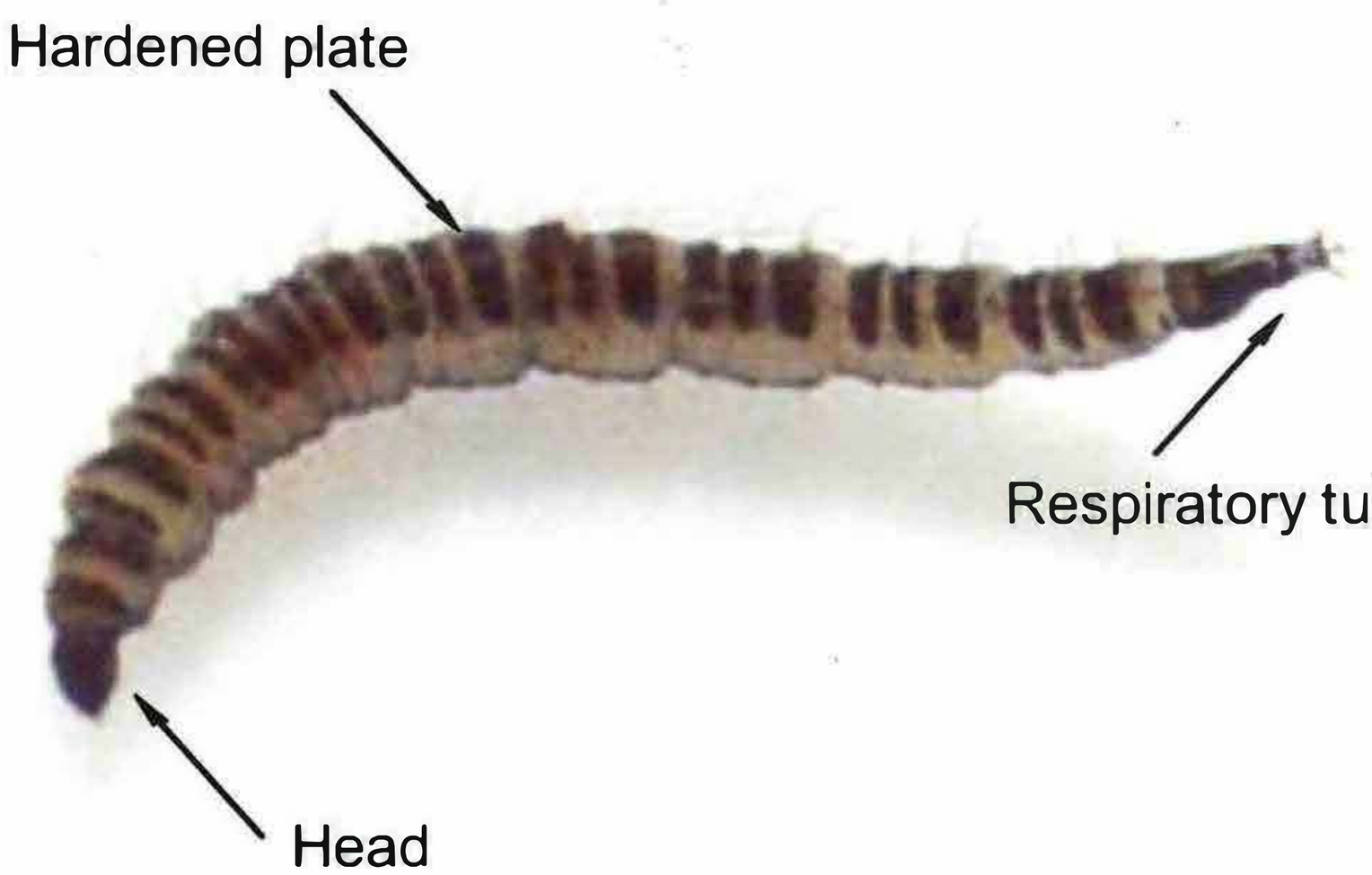
Habitat

- Streams
- Stagnant puddles with decaying organic matter (certain species only)

Colour

- Grey and black

Sensitivity



Approximate Size

Psychodidae larva

Family name : Simuliidae

Common name : *Black flies*

Structure

- Soft, smooth bodies, swollen at the base
- A single round, hooked sucker at the base
- A single proleg behind the head
- Two fan-like structures on the head

Behaviour

- Attaches itself to substrate, with head downstream, filters food from water
- Move around in looping manner using sucker and proleg

Habitat

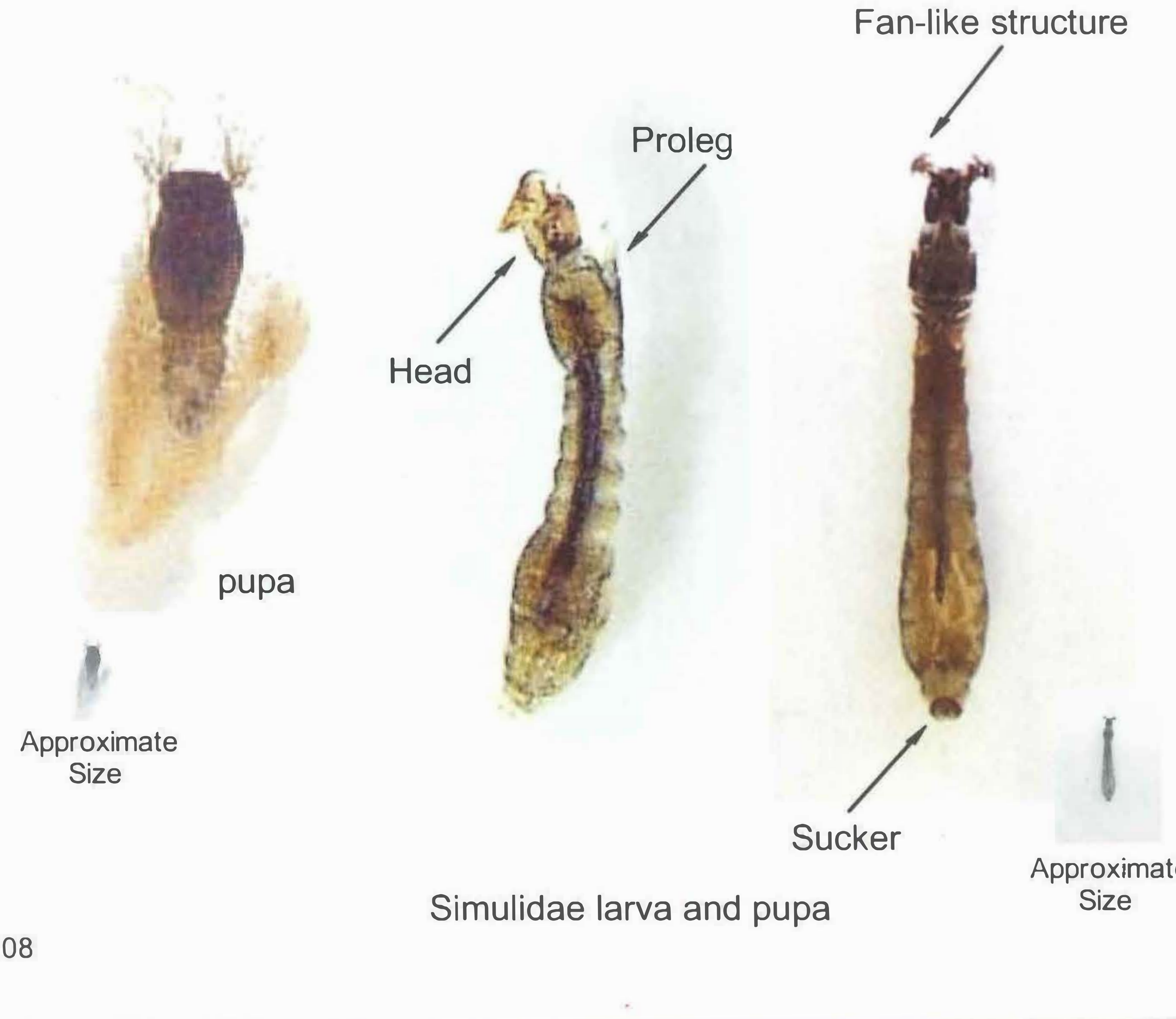
- Stones, plants any solid surface
- Shallow, rapid streams

Colour

- Brown, gray, black

Sensitivity

1 5 10 15



Simulidae larva and pupa

Family name : Syrphidae

Common name : Rat-tailed maggots

Structure

- Soft, wrinkled appearance
- Seven pairs of prolegs
- Small retracted head
- Telescopic respiratory tube

Behaviour

- Inactive, merely staying in a position close to surface to use respiratory tube

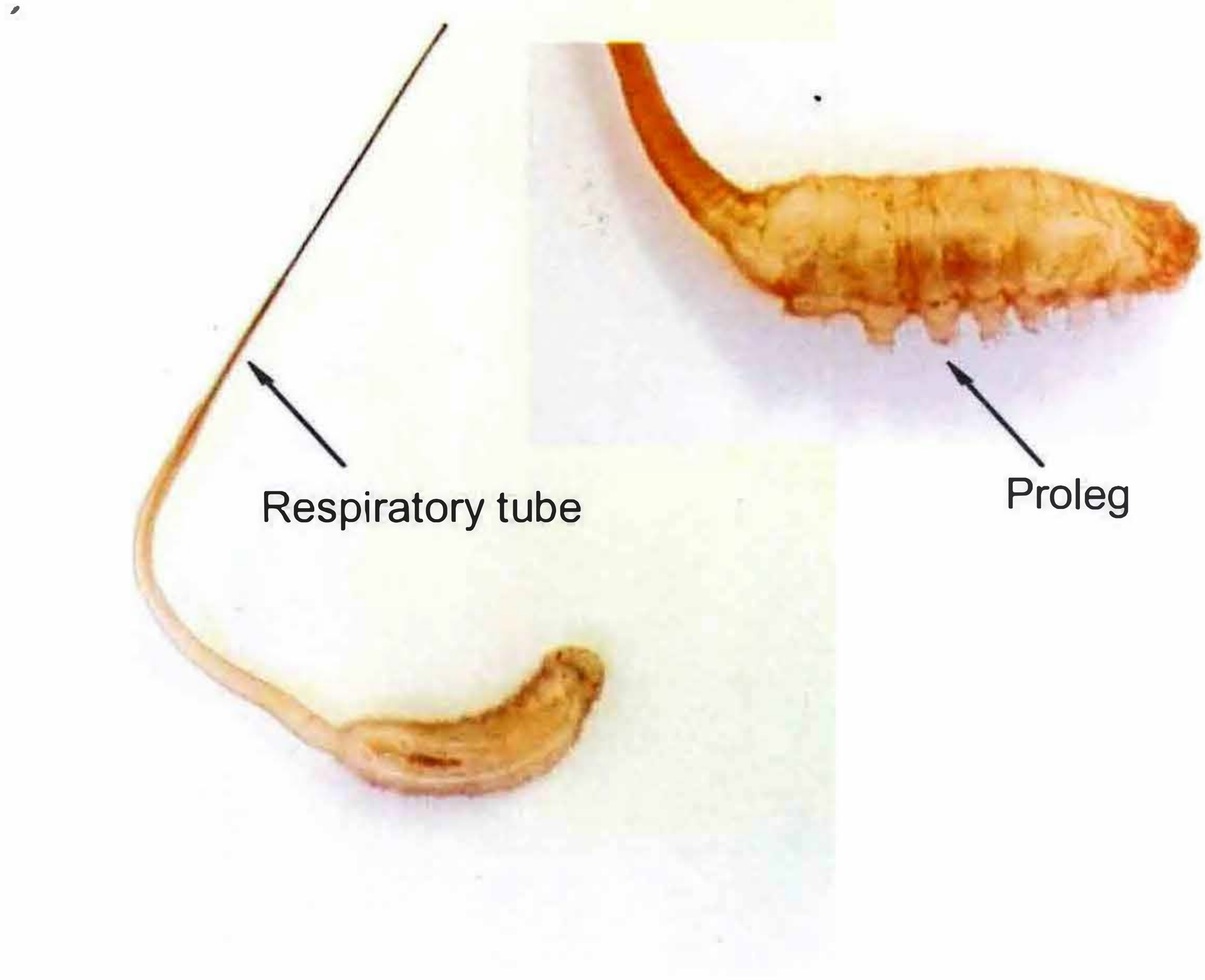
Habitat

- Water-filled holes, polluted streams, decaying vegetation on the edges of ponds

Colour

- Creamy brown

Sensitivity



Approximate Size

Syrphidae larva

Family name : Tabanidae

Common name : *Horseflies*

Structure

- Large, cylindrical, pointed at both ends
- Very small retractable head
- Creeping ridges encircling all abdominal segments
- Short siphon at tip of abdomen

Behaviour

- Body contracting and expanding lengthwise
- During this motion the intestines also seem to move back and forth

Habitat

- Muddy areas of pools and streams

Colour

- White, off-white

Sensitivity

Approximate Size

Tabanidae larva

Family name : Tipulidae

Common name : *Crane flies*

Structure

- Large, soft, cylindrical
- Very small retractable head
- Respiratory disc at end of abdomen consists of arrangement of hairs and lobes
- One species without disc, with only two appendages

Behaviour

- Active twitching of body , folding head across abdomen
- One type inflates one segment of the abdomen to look like a bubble

Habitat

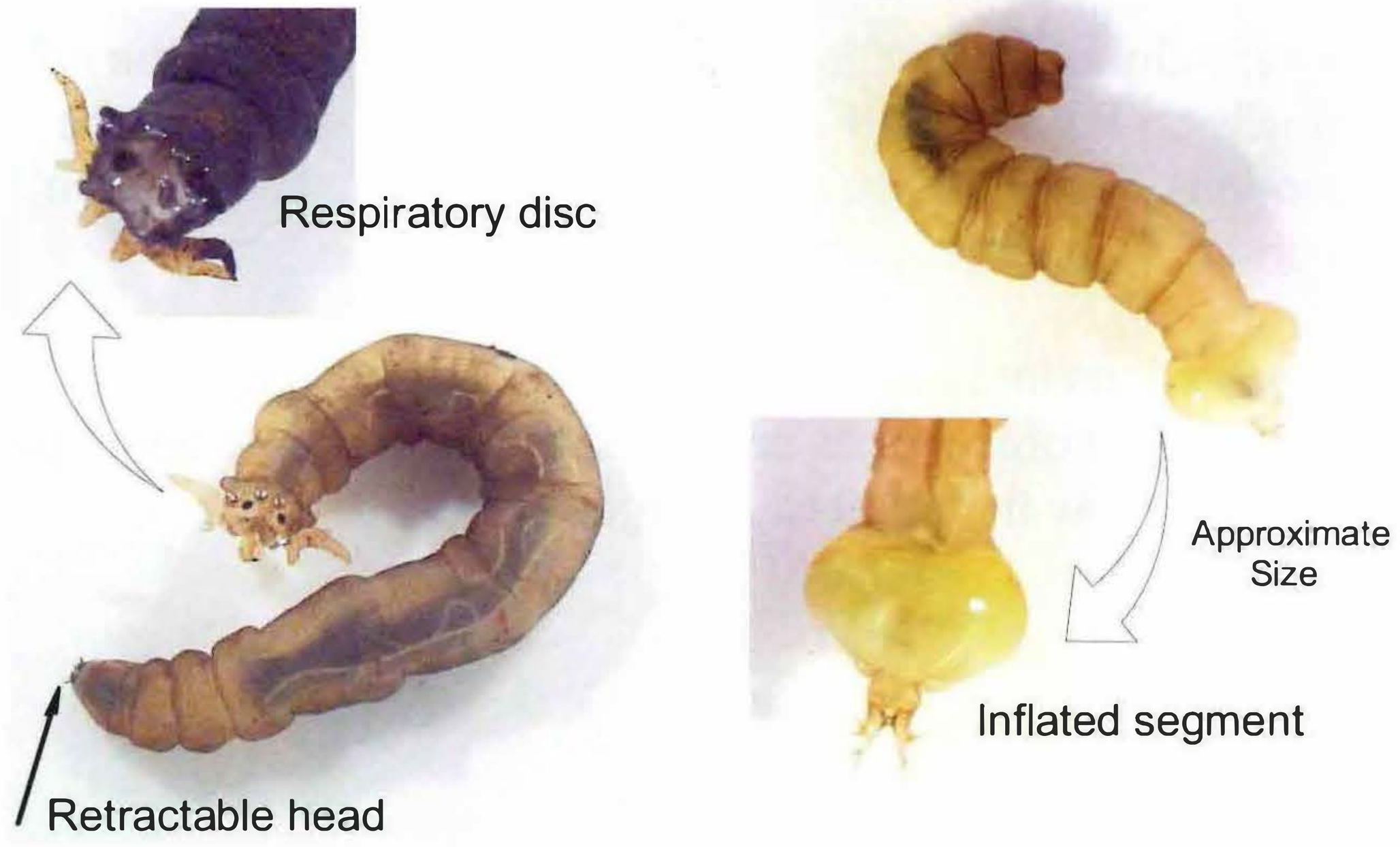
- Species are habitat specific
- Bottoms of streams, muddy edges of streams, under algal scum or in aquatic mosses

Colour

- Off-white to brown

Sensitivity

1 5 10 15



Tipulidae - different species

ORDER : PLECOPTERA
Stoneflies

Stoneflies are a common sight around unpolluted rivers where adults can be spotted as they clamber about on the rocks.

Plecoptera nymph

The nymphs are strictly aquatic and occur under stones in every kind of unpolluted stream with an abundance of oxygen. They can also be seen in debris, algae or masses of leaves.

Some species of Perlidae are brightly coloured with yellow and black on the backs while the smaller Notonemouridae are dull and inconspicuous.

A very characteristic feature of Perlidae nymphs are the tufts of gills on the side of the body as well as gills between the two tails. These gills can be seen with the naked eye when working with large specimens.

After various immature stages, the nymphs would crawl out of the water onto stones or debris. The skin on the back splits open to allow the adult to emerge.

These young adults usually sit for a while until the body and wings have hardened, after which they fly away or crawl out of sight. Sometimes dry cast skins can be found on stones along a river's edge.

Adult Plecoptera

Plecoptera skin on a rock

Family name : Notonemouridae

Common name : *Stoneflies*

Structure

- Small, slender
- Two tails
- Gills absent

Behaviour

- Slowly running or swimming

Habitat

- Under stones, amongst dead leaves
- Fast flowing streams
- Mountain streams and coastal streams

Colour

- Grey or brown

Sensitivity

Approximate Size

Notonemouridae nymph

Family name : Perlidae

Common name : *Stoneflies*

Structure

- Large, robust
- Two tails
- Clearly segmented upper body
- Gills present

Behaviour

- Slowly running or swimming
- Moves body rhythmically up and down when at rest

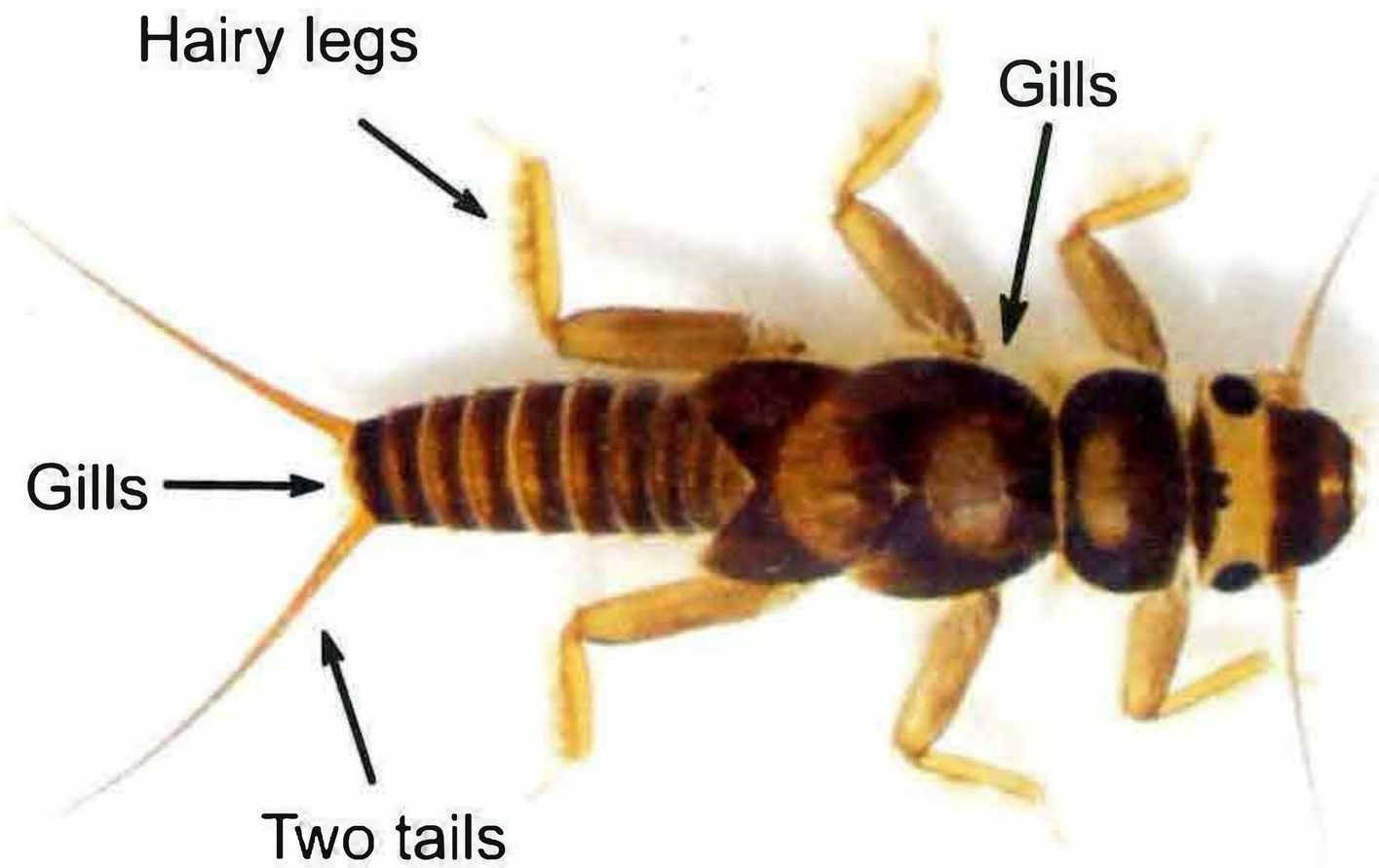
Habitat

- Under stones, amongst dead leaves
- Fast flowing streams
- Northern and Eastern half of the country

Colour

- Brown or black with yellow

Sensitivity



Approximate Size

Perlidae nymph

ORDER : LEPIDOPTERA
Aquatic caterpillars

Lepidoptera are characteristically terrestrial but one family includes a couple of species with truly aquatic larvae. These larvae have the characteristic caterpillar body shape as well as the legs and prolegs as in the terrestrial species.

The larvae either live in cases attached to floating vegetation, or in silken nets on rocks in rapid streams.

Mouthparts are adapted for scraping algae off the rocks. The bodies are covered with gill filaments for respiration purposes

Pyralidae inside a stone shelter

Family name : Pyralidae

Common name : *Aquatic caterpillars*

Structure

- Soft, worm-like bodies
- Six legs
- Five pairs of prolegs on abdomen
- Body covered with gill filaments

Behaviour

- Hiding inside silk or stone shelters

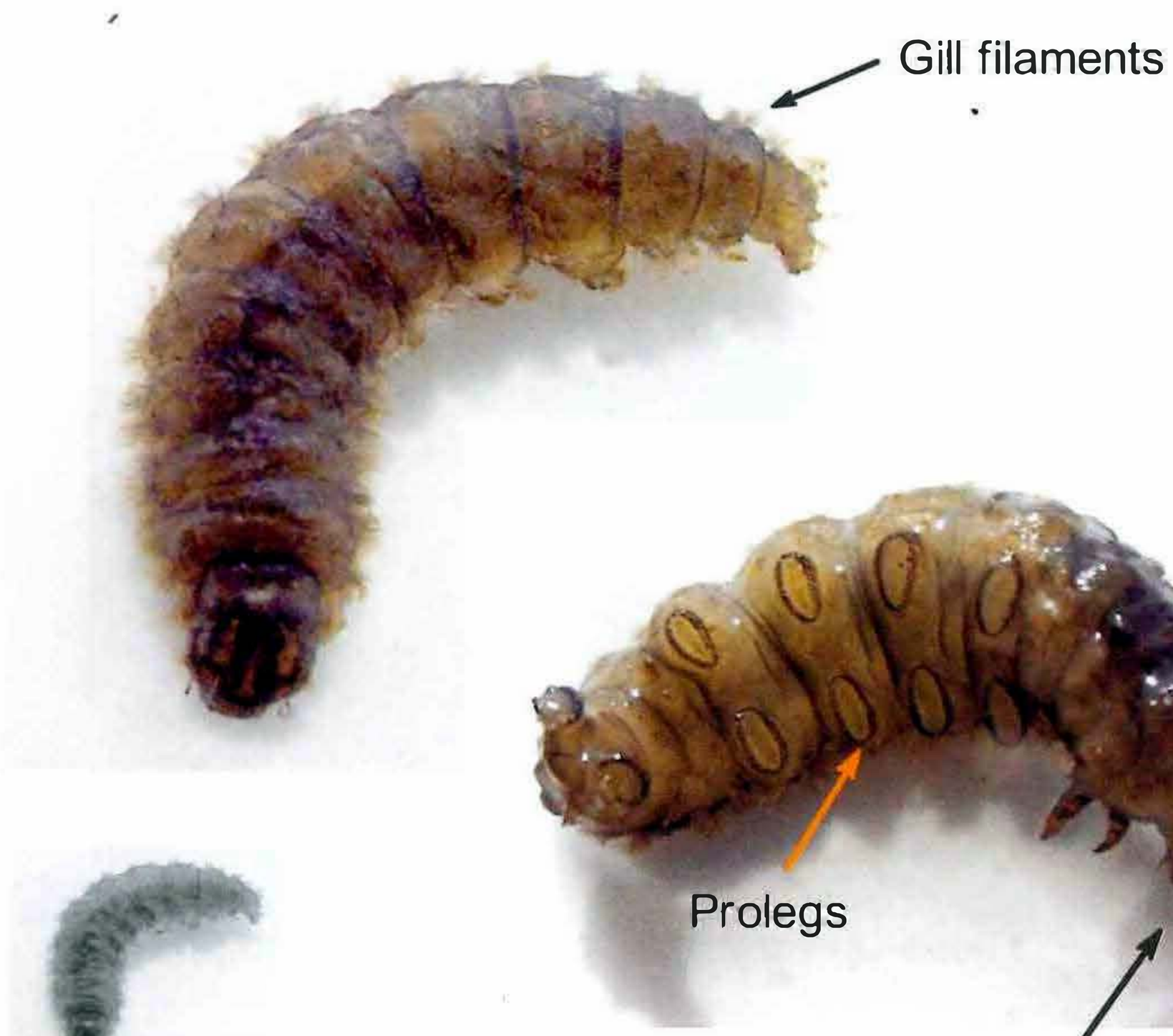
Habitat

- Exposed rock surfaces
- On submerged plants or algae
- Rapid streams

Colour

- Creamy brown to brown

Sensitivity



Approximate Size

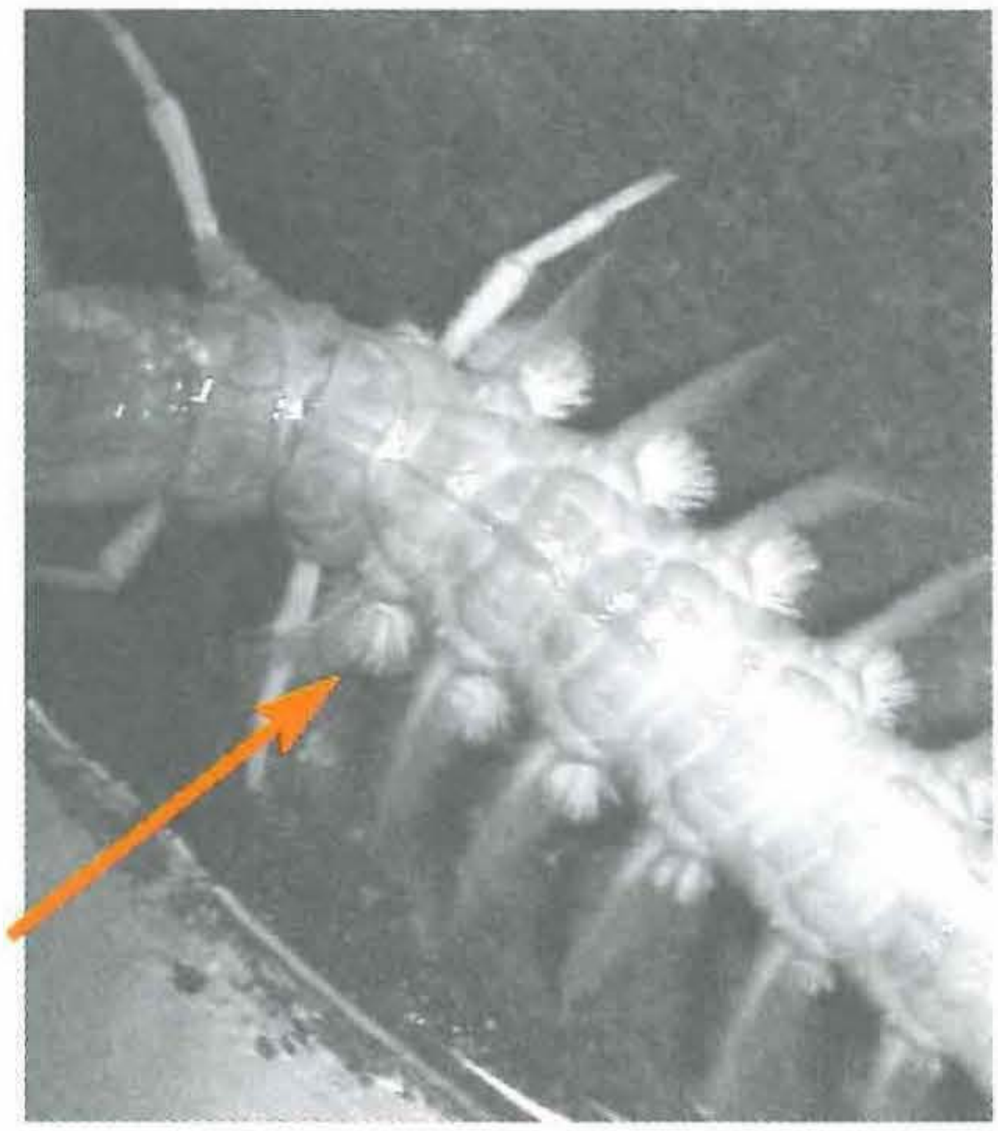
Pyralidae nymph

ORDER : MEGALOPTERA
Dobsonflies

The order Megaloptera is a small order of insects with only two families. Larvae of all species of Megaloptera are aquatic and are also the largest of all aquatic insects. These larvae are among the most striking of aquatic insects. They can easily be identified
by the long cylindrical body shape resembling that of centipedes.

The family Corydalidae have 8 pairs of unsegmented appendages on the abdomen, with a tuft of hairlike gills at the base of each appendage. The respiratory system of Megaloptera are efficient in such a way that they can survive out of the water for long periods of time provided the body stays damp. The abdomen ends in two hooked claws. The well developed mouthparts indicate that they are active predators, feeding on other aquatic insects.

Just before pupation the larvae crawl out of the water to pupate under stones or in the soil



Close-up view of Megaloptera showing the gills

Family name : Corydalidae

Common name : *Dobsonflies*

Structure

- Large, long, slender
- Eight pairs of segmented appendages on abdomen
- Tuft of gills at base of each appendage
- Well developed mouthparts
- One pair prolegs with claws on last segment

Behaviour

- Crawling over substrate
- Swims like a crayfish with abdomen folded under the body

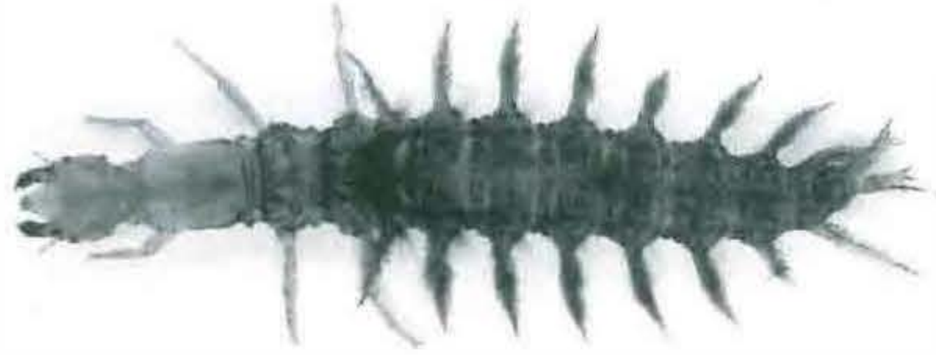
Habitat

- Under stones
- Fast flowing streams
- Mountainous areas of Cape Province and Natal

Colour

- Pale brown, reddish brown

Sensitivity



Approximate Size

Megaloptera nymph

TAXON : HYDRACARINA
Water mites

Hydracarina appear to be minute spiders, but differ from true spiders in the way that the head and body segmentation disappeared. All body segments are fused together into one single structure.

Generally the bodies are soft, smooth and round with four pairs of long hairy legs. Another pair of short appendages are situated close to the mouth, these are withdrawn into the head most of the time. Two minute eyes are situated towards the front of the body.

Although very small, Hydracarina are easily spotted due to their bright coloration which can vary from yellow to green or red. Dark markings are due to the digestive tract being visible through the skin

Hydracarina are most abundant in all freshwater habitats where they can cling to submerged vegetation or hang around in quiet pools.

Taxon : Hydracarina (Hydrachnellae)

Common name : *Water mites*

Structure

- Minute, round shape
- Soft body with translucent skin
- Eight legs
- Body not divided into separate segments

Behaviour

- Swimming, using all eight legs

Habitat

- Submerged vegetation or bottom debris
- Slow streams or quiet pools

Colour

- Brown, green or red

Sensitivity

Approximate Size

Hydracarina

CLASS : TURBELLARIA
Flatworms

Freshwater Turbellaria are more or less elongated, cylindrical or spindle-shaped worms worms. The general characteristics are the very flat bodies with one end widened to form an arrow-shaped head.
Two dark eyespots are situated on the head, the rest of the body is without legs or appendages.

Flatworms cannot swim but move over any solid substrate in a gliding fashion. This movement is done smoothly and effortlessly due to muscle contractions down the length of the body.

All Turbellaria are sensitive to strong light, for this reason they are more abundant in shaded areas or areas where they can hide and where there is a good supply of food.

Class : Turbellaria

Common name : *Flatworms*

Structure

- Elongated worms
- Very flat
- Arrow-shaped head with two eyespots

Behaviour

- Glide over any solid object
- Curled up when at rest

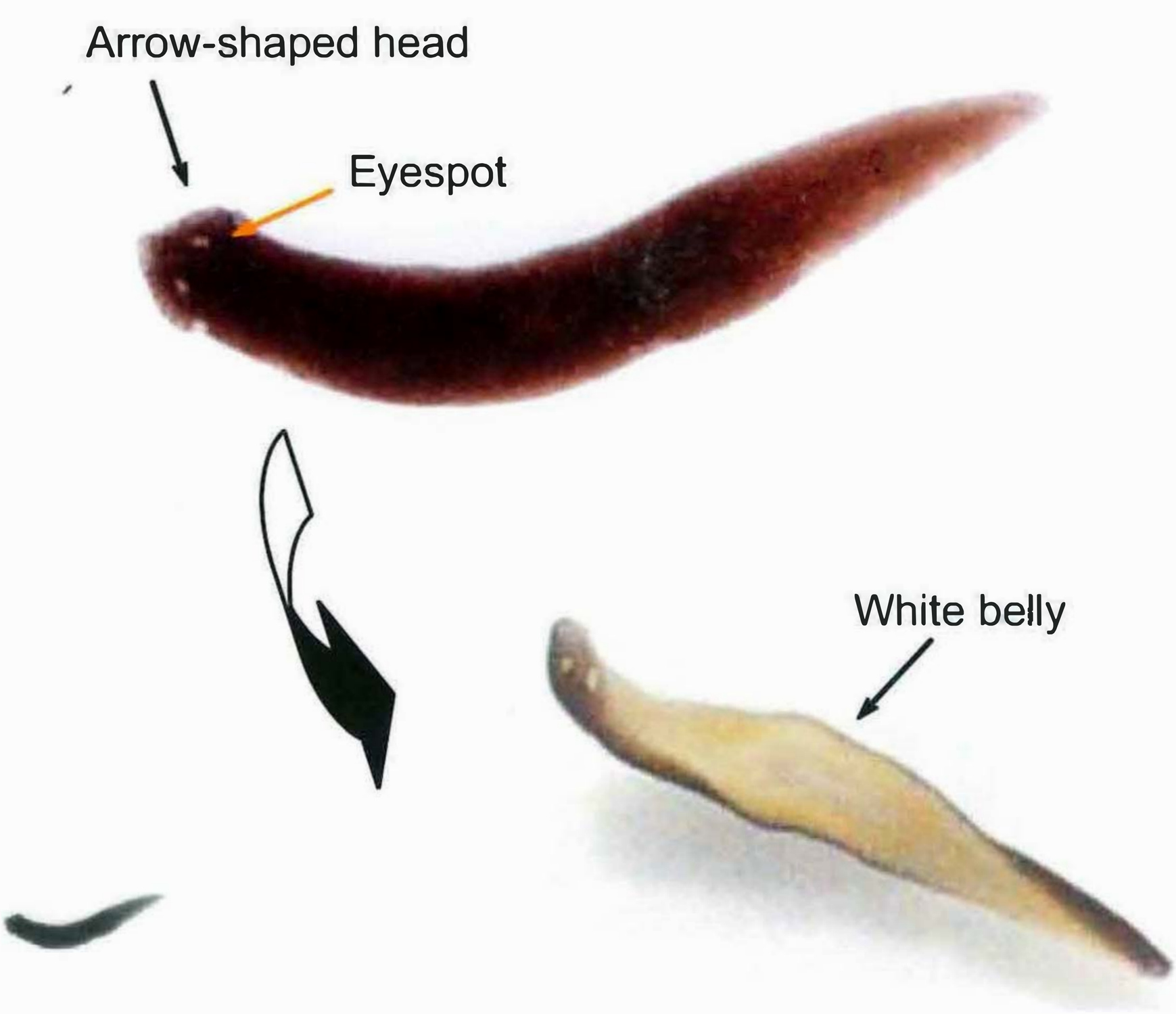
Habitat

- Under stones or any other solid substrate

Colour

- Dark on top, white underneath

Sensitivity



Planaria

ORDER : AMPHIPODA
Scuds

Freshwater Amphipoda are a varied group occurring in unpolluted rivers, caves or even in boreholes.
In general the bodies are slightly curved, flattened laterally, with two pairs of antennae and five pairs of walking legs. Scuds are higher than they are wide and swim rapidly on their sides.
Eyes are well developed except in the cave-dwelling species where the eyes can be absent. The cave-dwelling types are also pale or white-coloured opposed to the brightly coloured species in surface waters

Amphipoda are more active in the dark and stay hidden during the day-time, either under stones, amongst vegetation or buried beneath the top layers of soft bottom substrate.

Cave-dwelling Amphipoda are normally white, with eyes absent

Family name : Amphipoda

Common name : *Scuds, sideswimmers*

Structure

- Curved body shape
- Flattened side- ways
- Four antennae, two long, two short
- Five pairs walking legs

Behaviour

- Swim on the side or back
- Bury themselves under top layers of soft substrate

Habitat

- Under stones, amongst vegetation or on bottom debris
- Unpolluted rivers

Colour

- Cream, grey, brown or orange

Sensitivity

Approximate Size

Amphipoda

ORDER : DECAPODA
Crabs, shrimps

Decapoda represents all animals with bodies and legs hardened to form a tough shell. The head and upper body are fused together, but the abdomen has clear segmentation. Crabs differ slightly in that the abdomen is reduced and tucked away under the body.

In general, Decapoda would have four or five pairs of walking legs, of which the first pair is greatly modified with the tips enlarged to form claws with which to defend itself or to catch food.
Eyes are carried on stalks and are movable.

Family name : Potamonautidae

Common name : *Crabs*

Structure

- Bodies broad, no abdomen visible
- Four pairs jointed legs
- One pair appendages modified into pinchers
- Eyes on movable stalks
- Abdomen tucked away under body

Behaviour

- Running side-ways

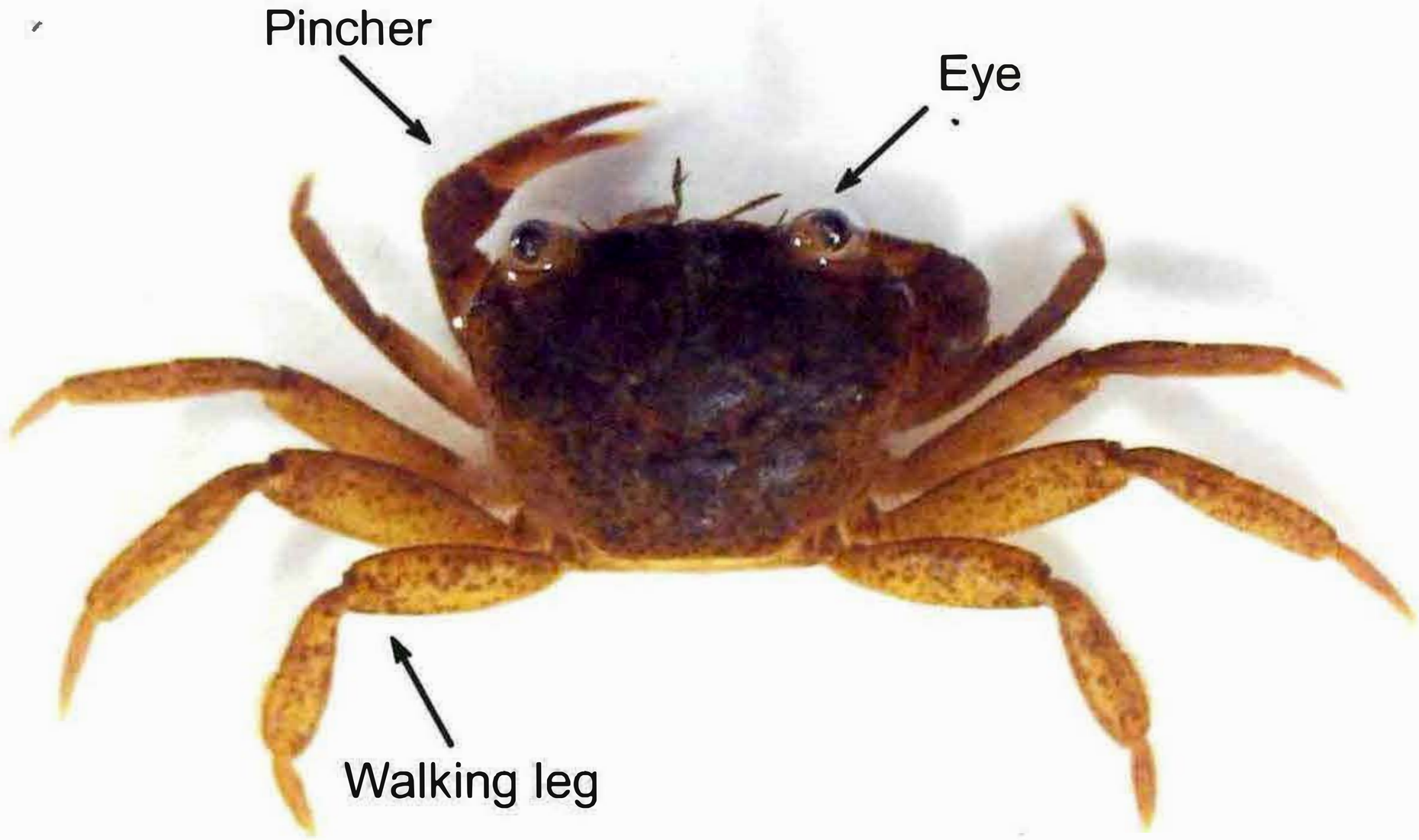
Habitat

- Under or amongst rocks

Colour

- Brown

Sensitivity



Approximate Size

Potamonautidae

Family name : Atyidae

Common name : *Freshwater shrimps*

Structure

- Bodies longer than broad
- Fan tail at end of abdomen
- Five pairs of legs
- Small pinchers on first two pairs of legs with tufts of long hair
- Eyes on movable stalks

Behaviour

- Moves very fast
- Jumps when disturbed or surprised

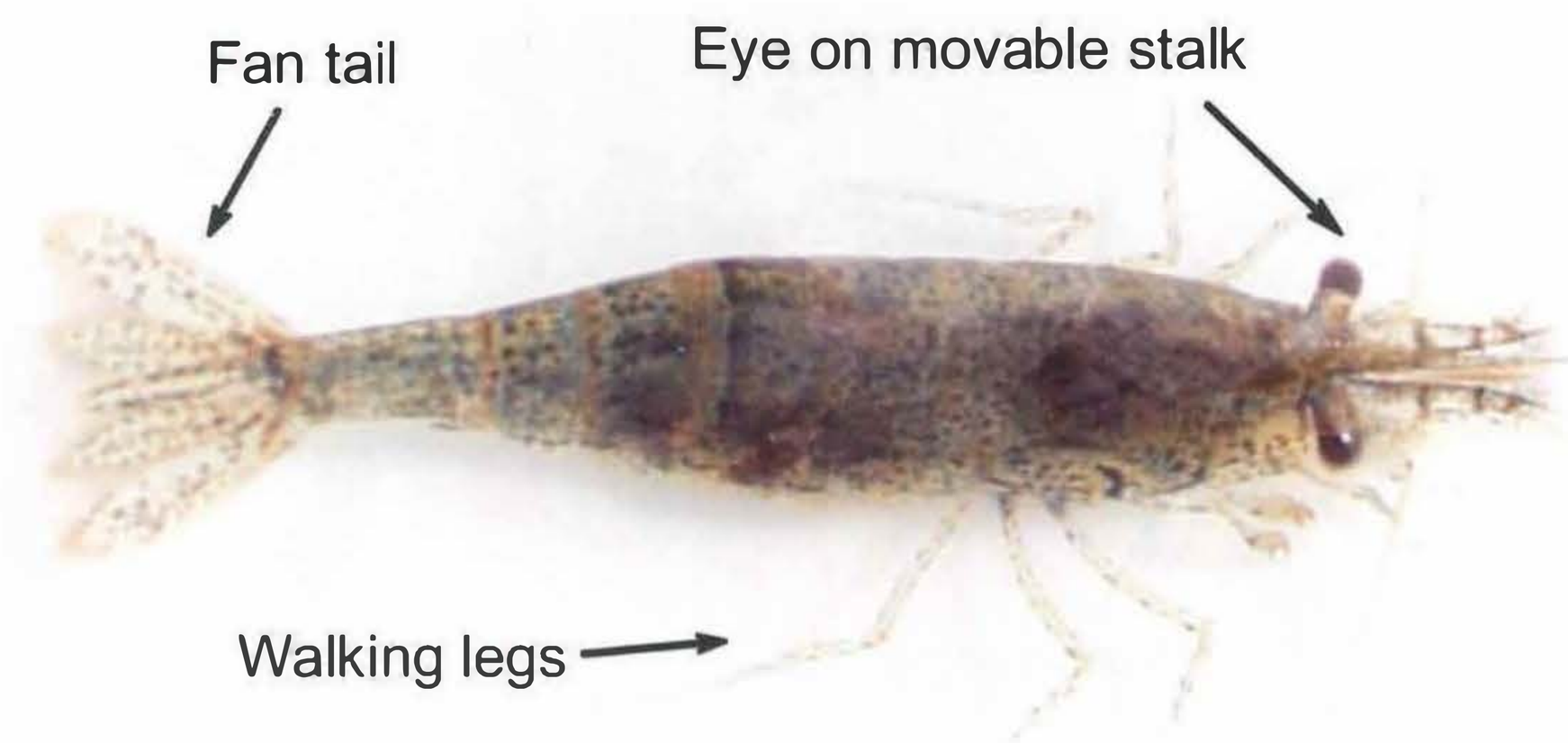
Habitat

- Among vegetation
- Edges of pools or streams

Colour

- Translucent grey, pink

Sensitivity



Approximate Size

Family name : Palaemonidae

Common name : *Freshwater prawns*

Structure

- Large animals, bodies longer than broad
- Fan tail at end of abdomen
- Five pairs of legs, second pair much longer than the others
- Pinchers on front legs without any hair

Behaviour

- Moves extremely fast

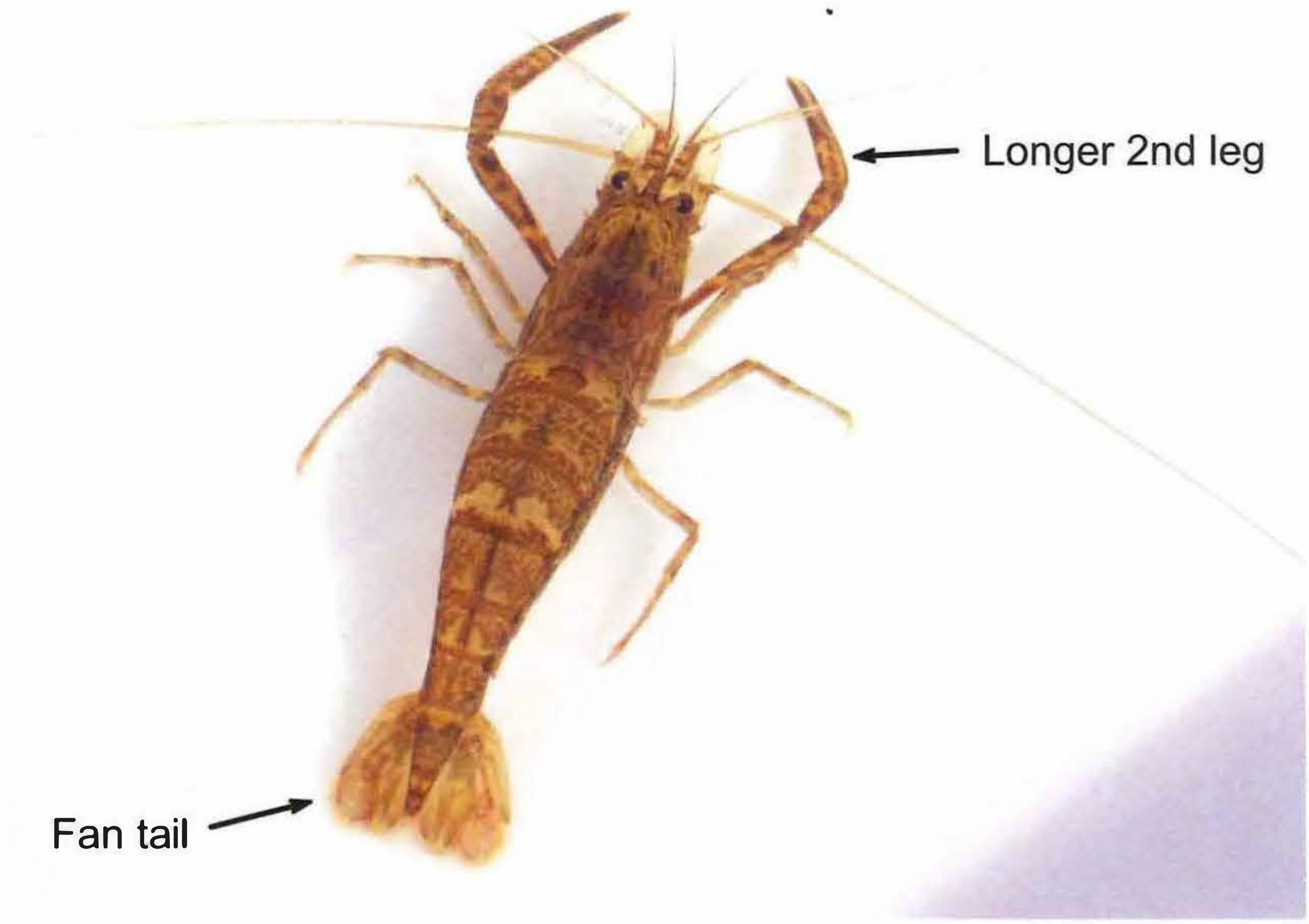
Habitat

- Among stones, in rock crevices
- In riffle areas
- Macrobrachium spp in Kwazulu Natal

Colour

- Mottled grey

Sensitivity



Approximate Size

Palaemonidae

PHYLUM : ANNELIDA
CLASS : OLIGOCHAETA
Aquatic earthworms

Annelida, or segmented worms as they are commonly known, are worm-like animals with soft muscular bodies.

Aquatic Oligochaeta have the same structure as the common garden earthworms. The body is in the form of a tube, with no definite head, no tentacles or legs. The body wall is thin and translucent, and the internal organs can easily be seen. Bundles of hair, that help with movement, are present close to surface of the body. These, however, are not visible to the naked eye.

Oligochaeta are common in the mud and bottom substrate of stagnant pools where they lie coiled up or probe around, digesting the substrate. They can survive very low levels of oxygen.

Class : Oligochaeta

Common name : *Aquatic earthworms*

Structure

- Long, thin, soft and muscular
- Thin, translucent body wall
- No legs or tentacles
- Bundles of hair close to surface of the body

Behaviour

- Crawling about in the muddy substrate
- Inactive in a coiled up position

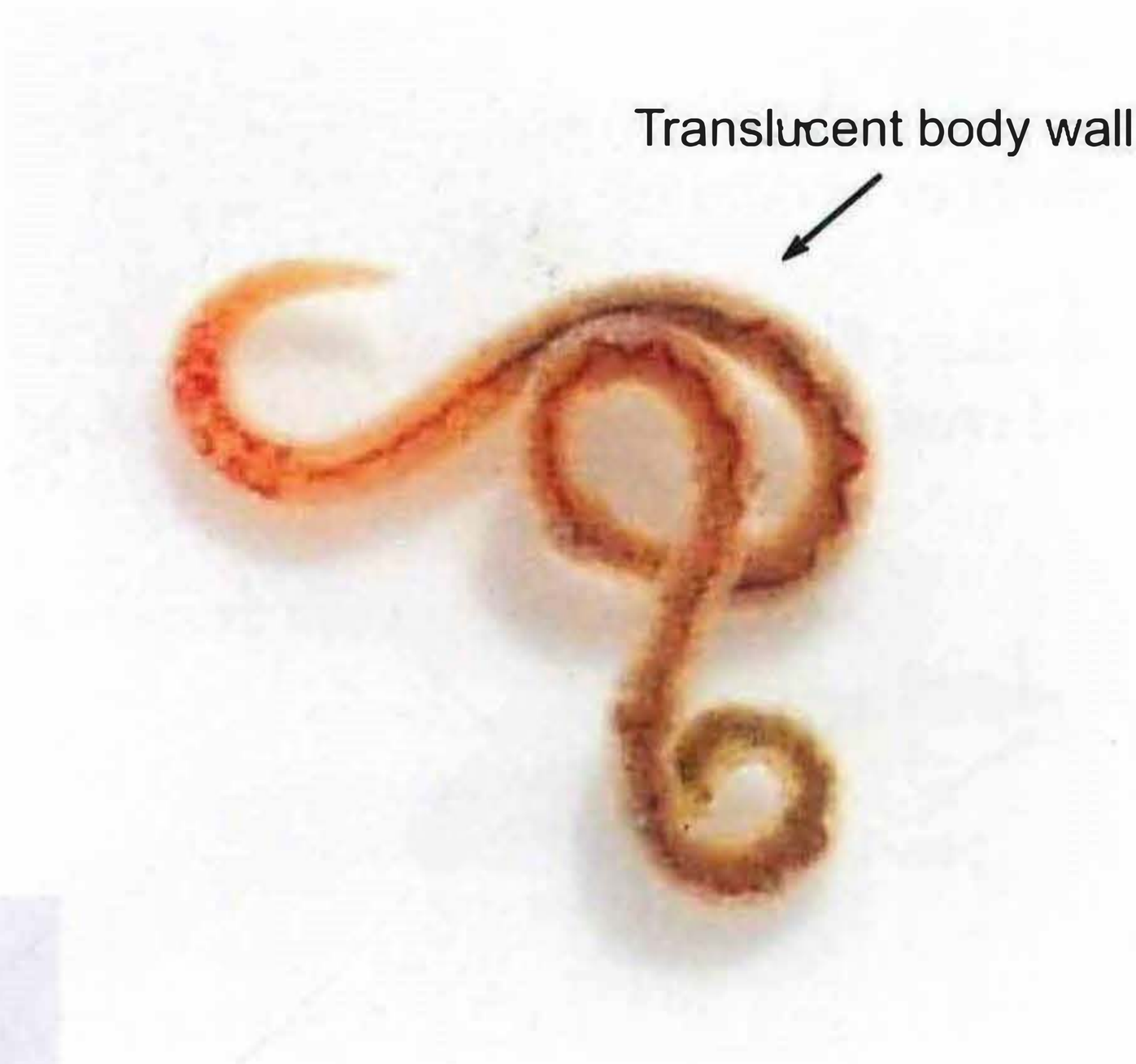
Habitat

- Mud or bottom substrate
- Pools or quiet area of a stream

Colour

- Pink

Sensitivity 1 5 10 15



Approximate Size

Oligochaeta

PHYLUM : ANNELIDA
CLASS : HIRUDINAE
Leeches

Hirudinae is commonly referred to as "bloodsuckers" but only a few freshwater species will take blood from warm-blooded animals.
Hirudinae differ in size from minute to the giant species that can reach up to 45cm when extended.

The segmented body is not as soft as with Oligochaeta, but also in the shape of a tube, flattened and very muscular.
They have suckers on both ends of the body, the front sucker being the smaller one and more or less fused with the body.
Both suckers are used for attachment, feeding and locomotion which is in a looping fashion. The rear sucker holds on to substrate while the body stretches out far forward, grabs onto something with the front sucker, and let go at the rear to bring that end of the body forward.

Leeches avoid light and generally hide under stones or among plants or in detritus

Certain species of leeches are often parasitic and can be seen on fish and crustaceans where they feed on blood and tissue fluids.

Class : Hirudinae

Common name : *Leeches*

Structure

- Flattened, with rear slightly wider than front
- No legs or tentacles
- Suckers at both ends of body

Behaviour

- Move in a creeping, looping fashion
- Swim with side-to-side motion, with body stretched out

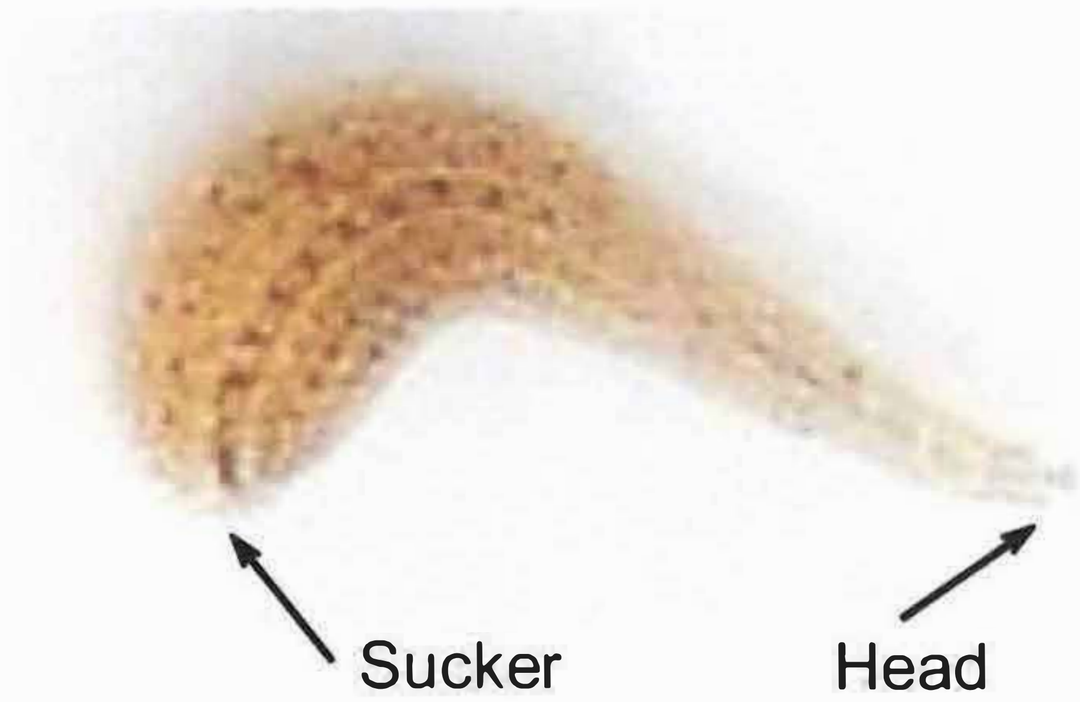
Habitat

- Under stones, vegetation or debris
- Shallow pools or quiet areas of river

Colour

- Pale with bright spots or stripes, brown or black

Sensitivity



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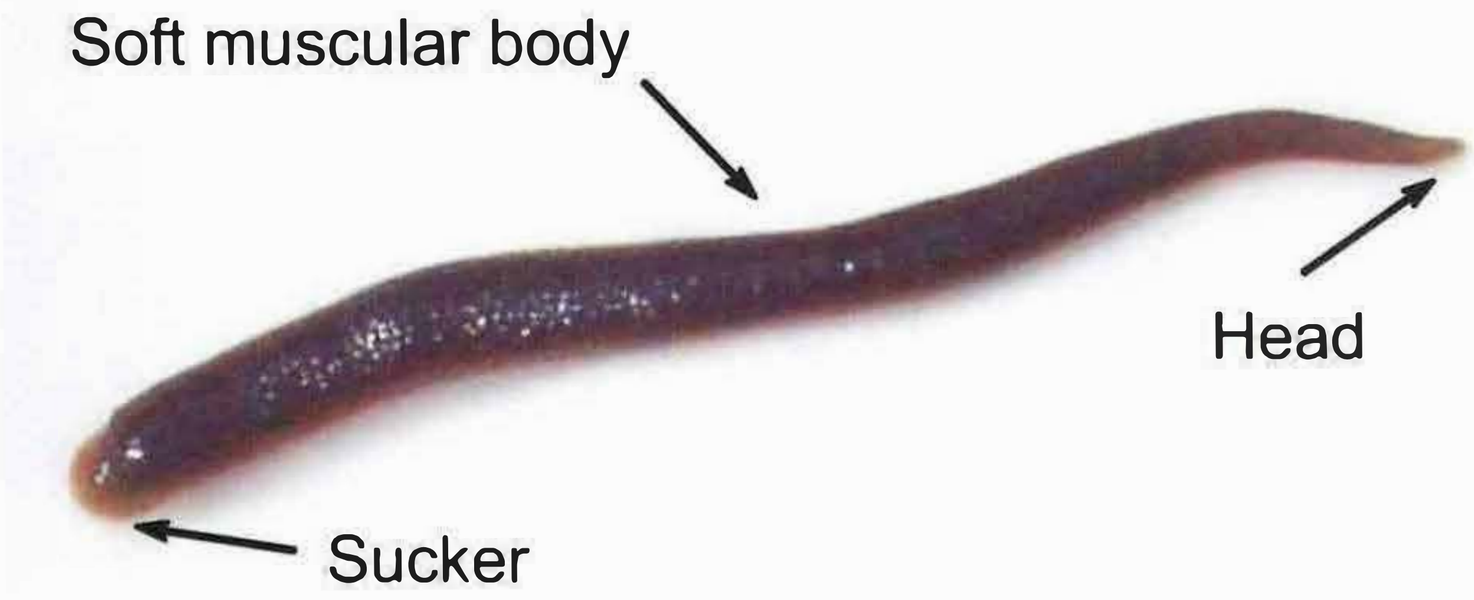


Approximate Size

Hirudinae

PHYLUM : PORIFERA
Sponges

Porifera differ greatly from other freshwater invertebrates and are mostly overlooked or mistaken for plants.

Sponges are sessile, inconspicuous animals that will live only in clean ponds or slow streams. The general forms are crusty, mat-like patches on almost any stable submerged substrate such as pebbles, rocks, logs or twigs. Sponges growing actively can cover large areas of substrate, covering upper and lower surfaces or the sides.
These patches are normally only 1-2 mm thick and consists of millions of microscopic needle-like structures growing in all directions.
These needle-like structures form a soft skeleton in and around the body tissue. Furthermore there are no organs or attachments.

Phylum : Porifera

Common name : *Freshwater sponges*

Structure

- Thin mat-like crust
- Feels slightly rough to the touch

Behaviour

- Sessile
- Growing in patches or covering large areas of substrate

Habitat

- On or under rocks, pebbles, any solid submerged substrate
- Unpolluted slow streams

Colour

- grey, green or black

Sensitivity

Actual size

Porifera

PHYLUM : MOLLUSCA
CLASS : GASTROPODA
Snails, limpets

Snails are soft-bodied unsegmented animals that live inside a shell. The majority of freshwater Gastropoda have spiral shells, only a few limpet genera have flatter more conical shells.

All Gastropoda are characterized by the large muscular foot that extends from under the shell. To the front of the foot lies a well developed head, bearing tentacles, eyes and a mouth. The exposed foot is anchored to the shell by means of a muscle which, when contracted, withdraws the foot from sight.

The shells may appear smooth but growth lines are present when examined closely. The shell is covered with a thin protective layer which also contains the colour pigments.

Snails move about slowly, gliding on the foot while leaving behind the familiar slime track.

Family name : Ancylidae

Common name : *Limpets*

Structure

- Shells flattened limpet-like
- Base of shell wide, round or oval
- Resembles a sand dune when viewed from the side

Behaviour

- Slow gliding movement

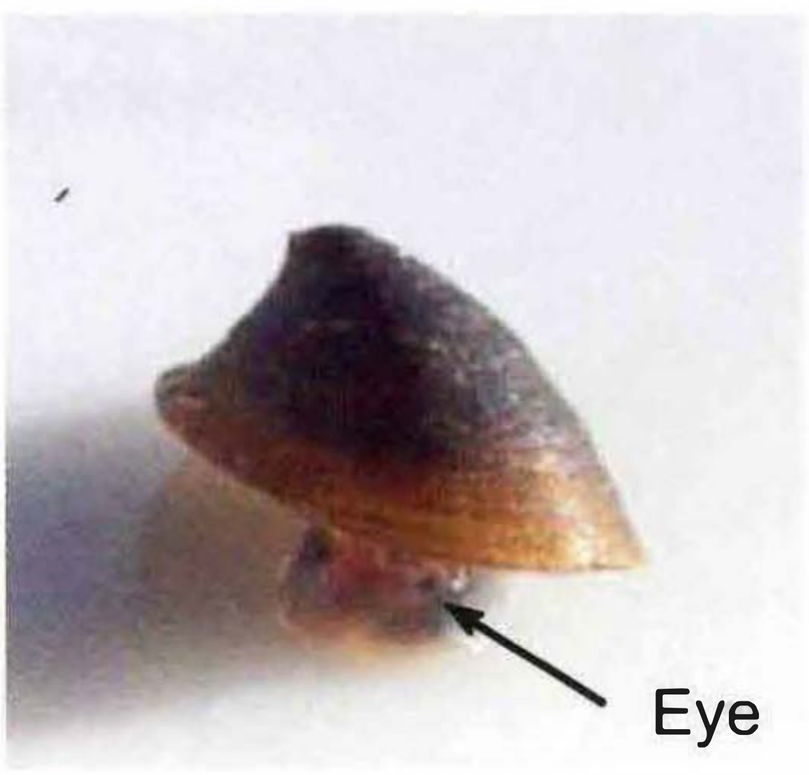
Habitat

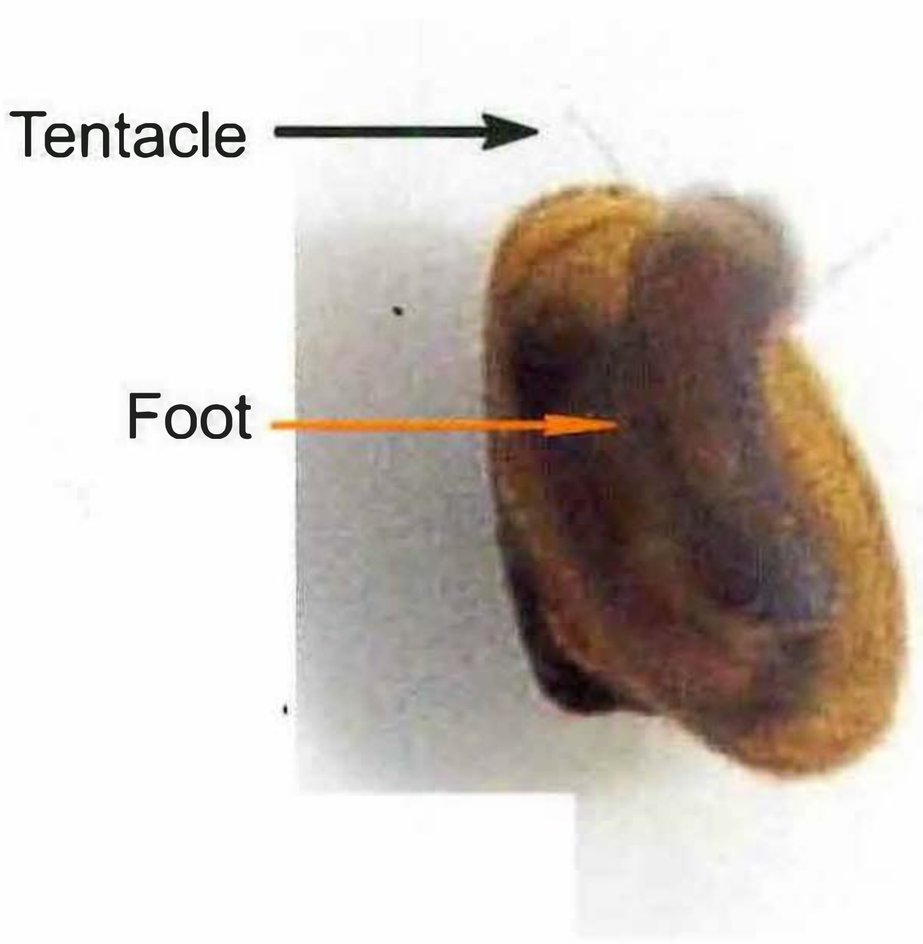
- On rocks or any solid submerged substrate
- All streams country-wide

Colour

- Brown or black

Sensitivity





Approximate Size

Ancylidae

Family name : Lymnaeidae

Common name : *Pond snails*

Structure

- Shell opening on the right
- Shell opening large, wide
- Triangular tentacles

Behaviour

- Slow gliding movement

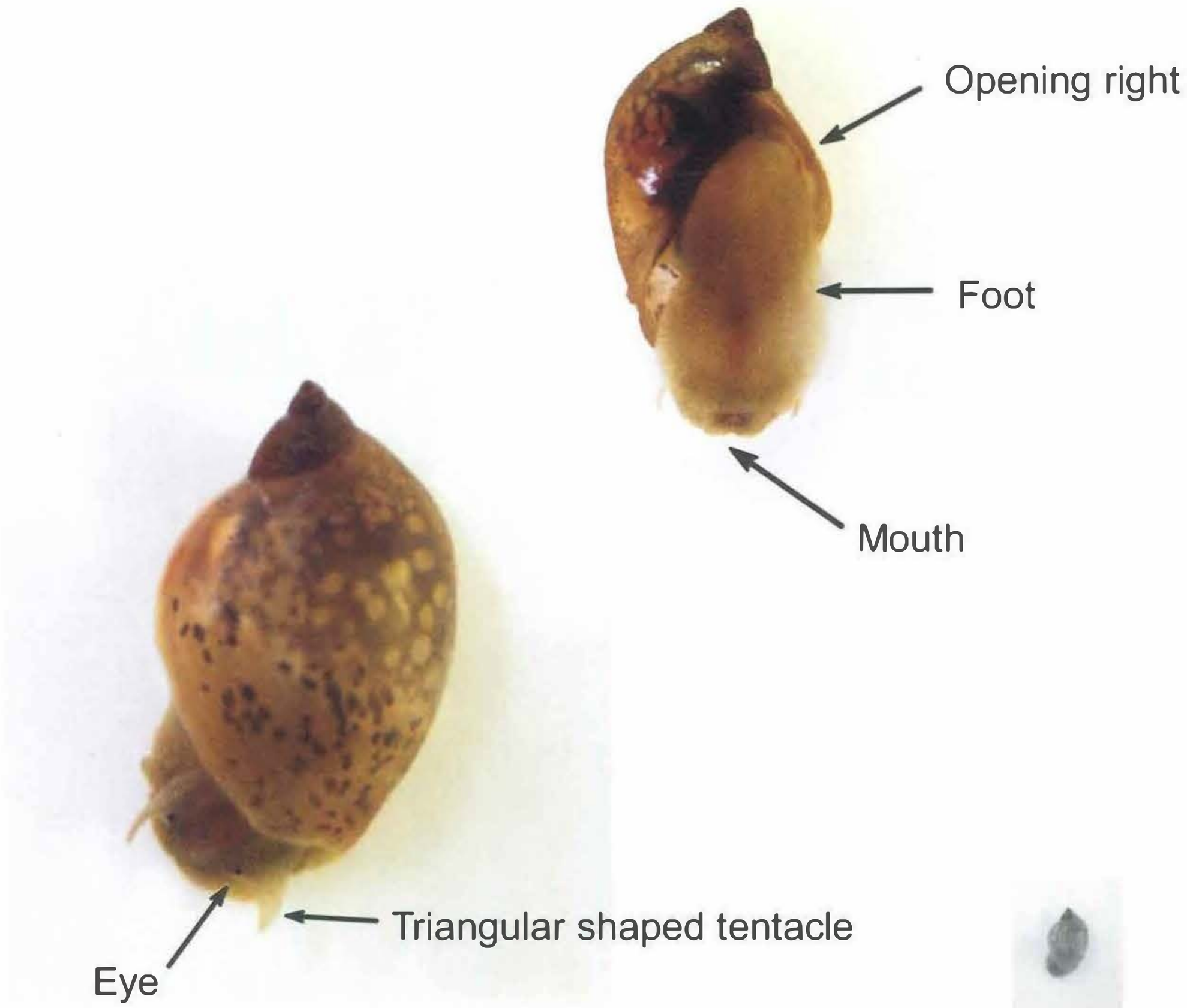
Habitat

- Gravel beds, or on aquatic vegetation

Colour

- Mottled brown

Sensitivity



Approximate Size

Lymnaeidae

Family name : Physidae

Common name : *Pouch snails*

Structure

- Shell opening to the left
- Shell smooth, glossy
- Slender tentacles

Behaviour

- Slow gliding movement

Habitat

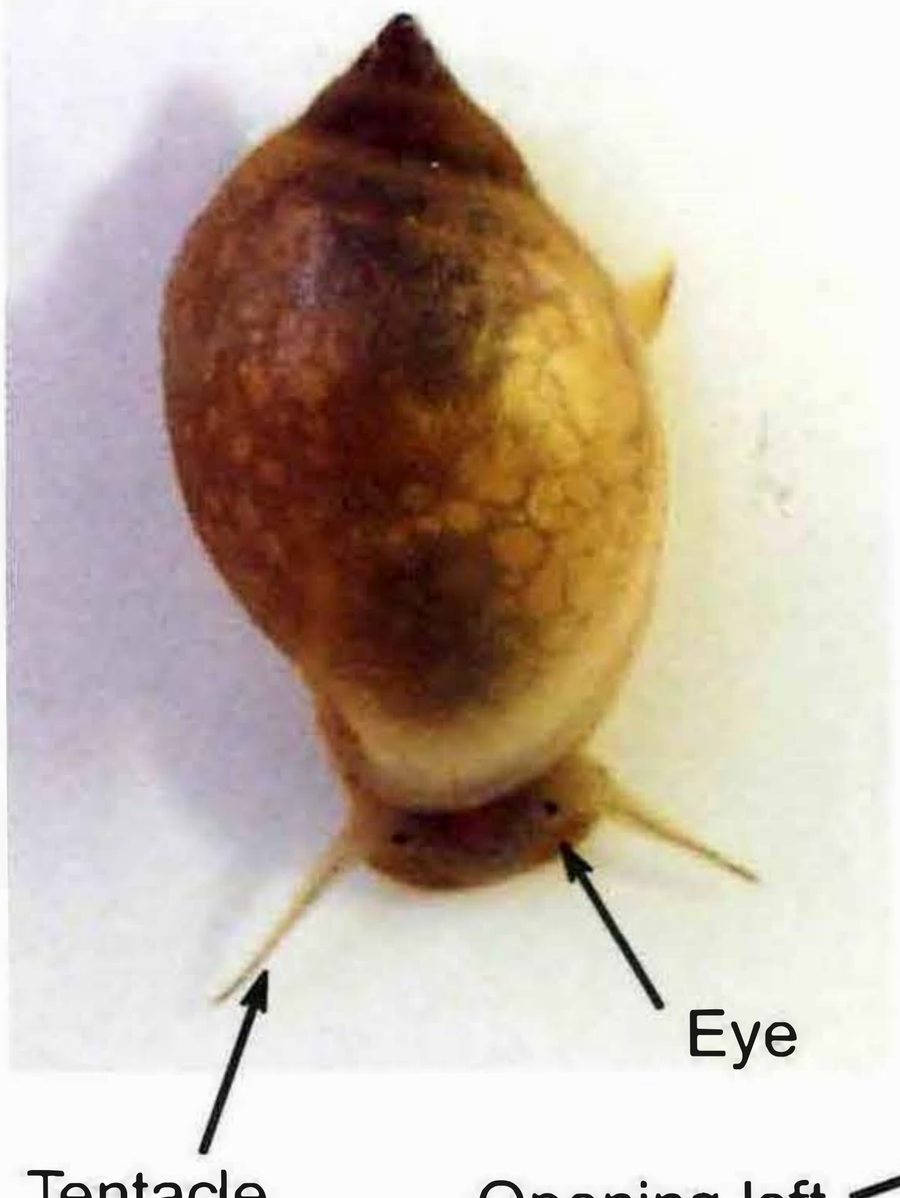
- Gravel beds, or on aquatic vegetation

Colour

- Brown

Sensitivity

1 5 10 15



Approximate Size

Physidae

Family name : Planorbidae

Common name : *Orb snails*

Structure

- Flat shell, tightly coiled
- Host for the bilharzia parasite

Behaviour

- Slow moving on the foot
- Shell in vertical position when animal moves around

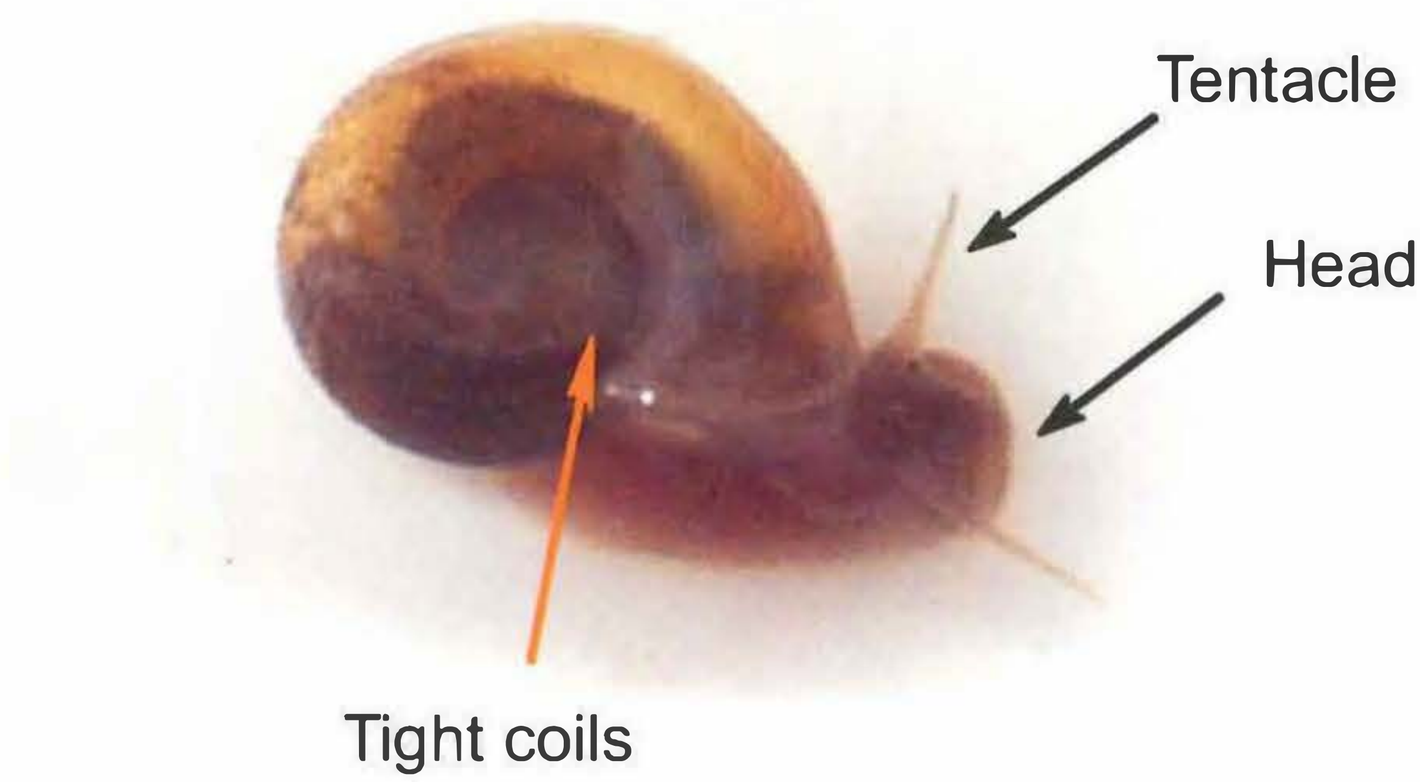
Habitat

- Gravel beds or aquatic vegetation
- Flowing streams

Colour

- Brown

Sensitivity



Approximate Size

Planorbidae

Family name : Thiaridae

Common name : *Snails*

Structure

- Strong, thick shell
- Well developed spiral
- Tubercles more pronounced in some individuals

Behaviour

- Slow moving on the foot

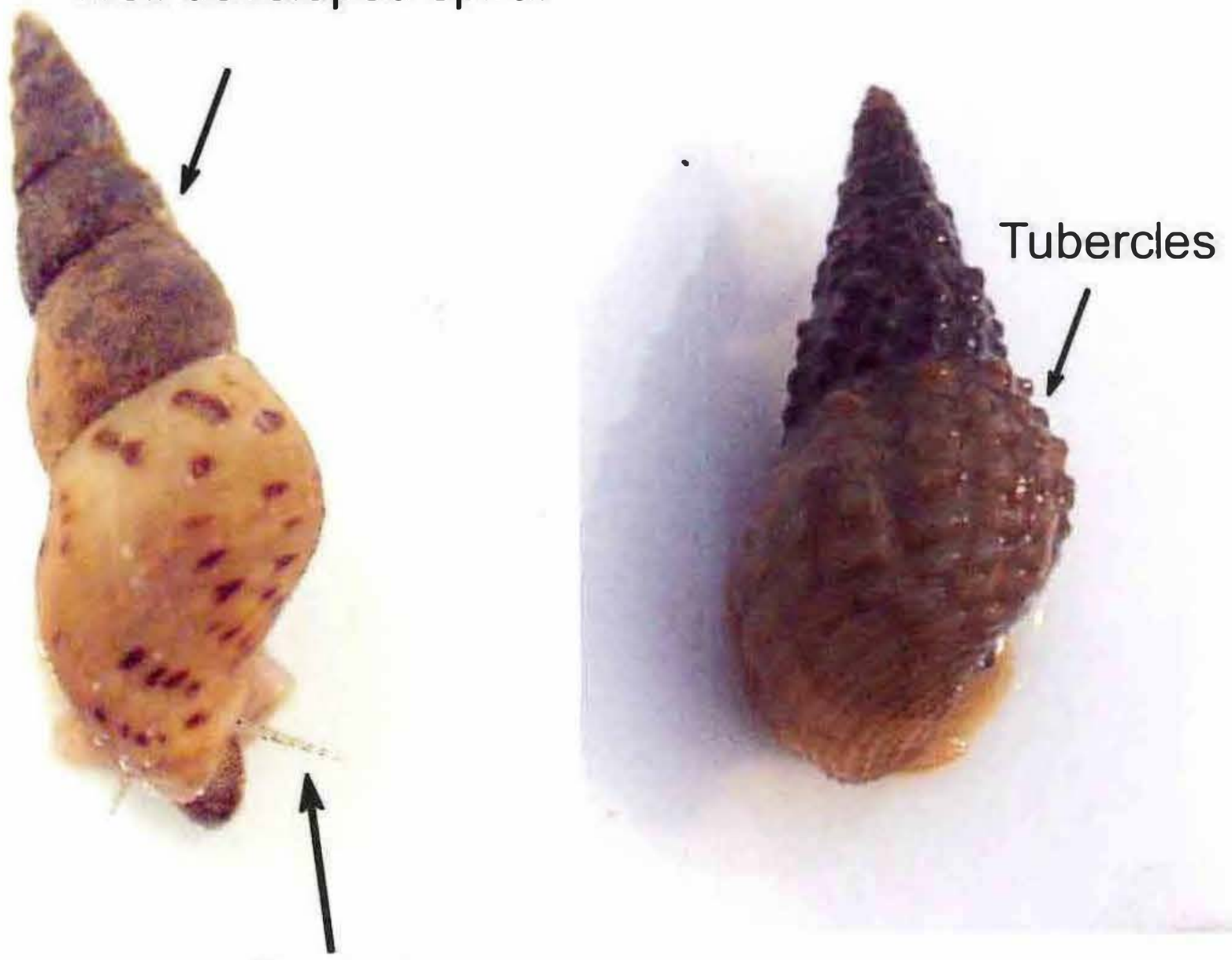
Habitat

- Gravel beds in flowing streams
- Silty substrate in pools

Colour

- Cream with brown markings, brown

Sensitivity



Approximate Size

PHYLUM : MOLLUSCA
CLASS : BIVALVIA (PELECYPODA)
Clams, mussels

Clams and mussels are varied in shape, elongated, oval or anything in between. The shell consists of two halves, joined together with an elastic ligament that forms a hinge.
The shells are often heavily marked with growth lines and imperfections due to periods of lack of food or low oxygen levels.

Clams and mussels also have a small muscular foot which extends from between the two shells. This is used mainly for locomotion as it does not have a proper head, eyes or tentacles .

Mussels and clams can bury themselves deep into the sand or substrate

Family name : Corbiculidae

Common name : *Clams*

Structure

- Strong hard shell
- Prominent growth lines
- Strong hinge

Behaviour

- Appears to be inactive

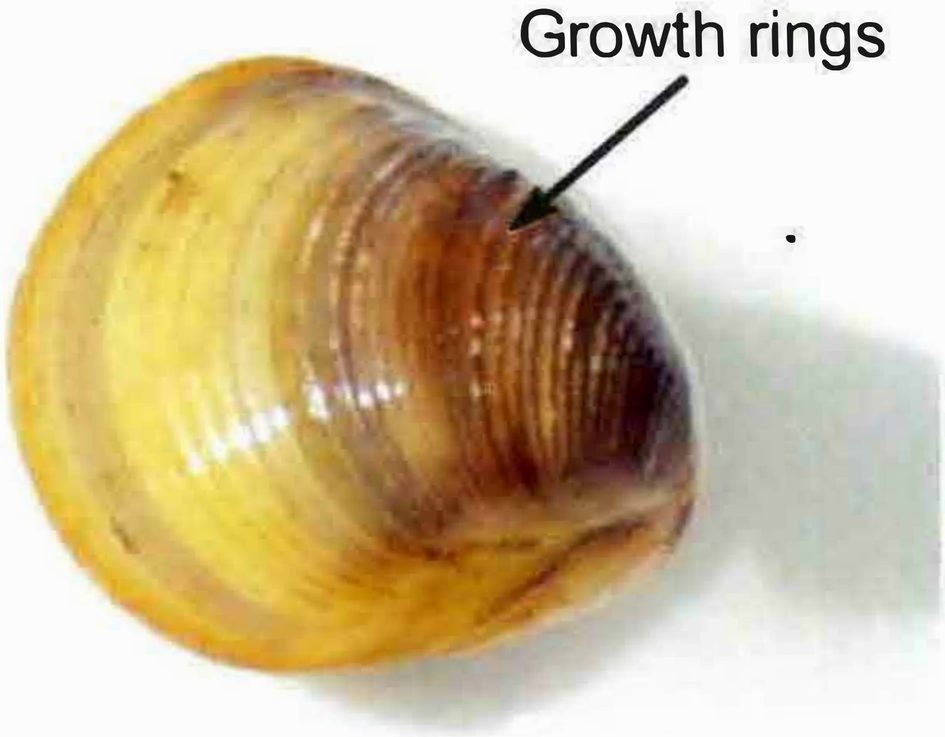
Habitat

- Sand or gravel beds
- Flowing streams

Colour

- Pale yellow, green or brown

Sensitivity



Approximate Size

Corbiculidae

Family name : Sphaeriidae

Common name : *Pill clams*

Structure

- Small, fragile shells
- Smooth without growth rings

Behaviour

- Inactive

Habitat

- Sand or gravel beds

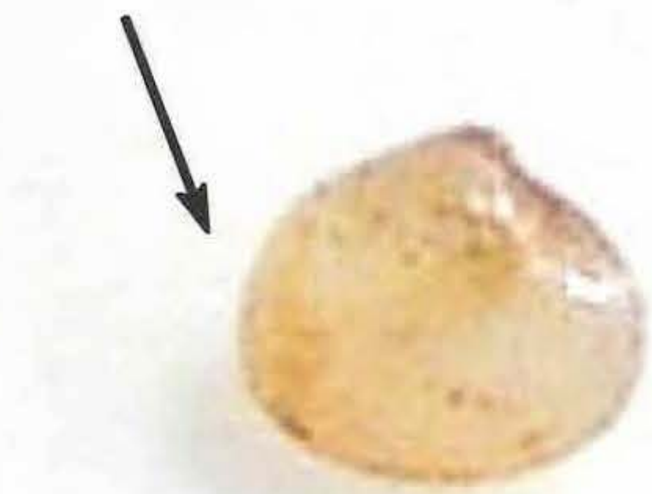
Colour

- Whitish
- Brown with dark speckles

Sensitivity

Approximate Size

Soft shell without growth rings



Approximate Size

Approximate Size

Family name : Unionidae

Common name : *Pearly mussels*

Structure

- Large elongate shells
- Prominent growth rings
- Erosion of the outer layer visible

Behaviour

- Inactive
- Two halves open slightly when filtering water

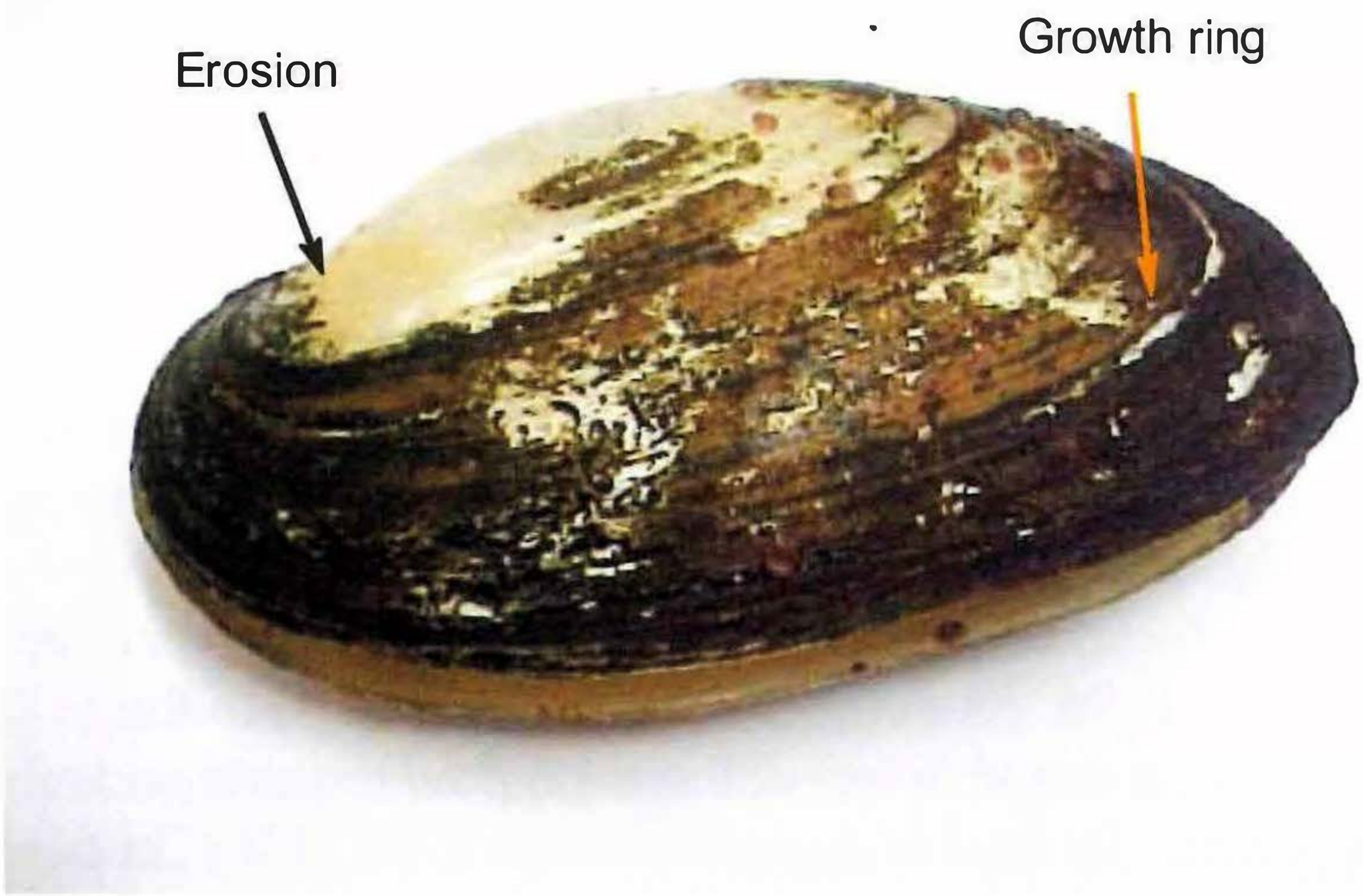
Habitat

- Deep muddy substrate

Colour

- Dark brown with pearly eroded patches

Sensitivity



Actual Size

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